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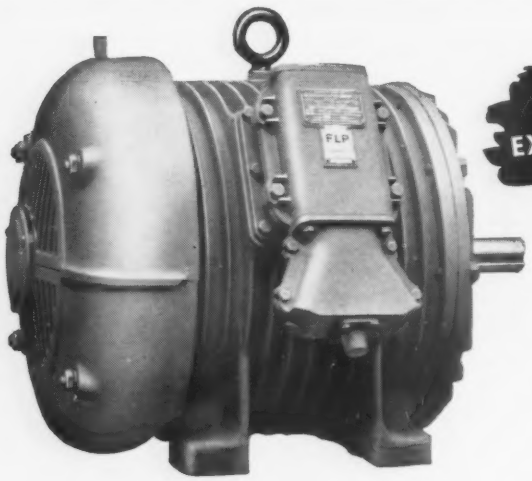

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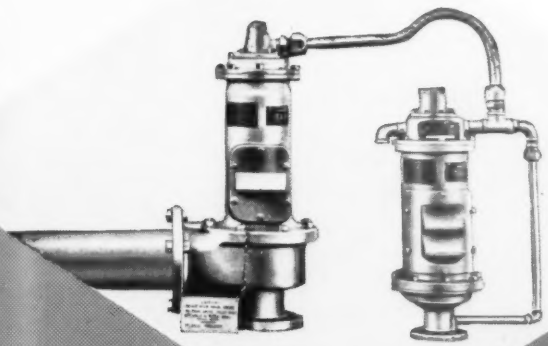

FIG. ST-2500
Safety Valve

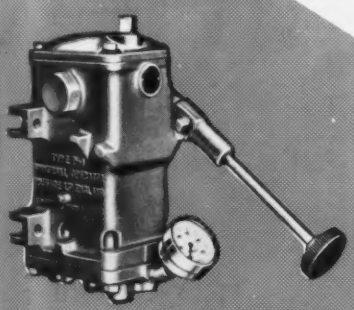

FIG. 13434
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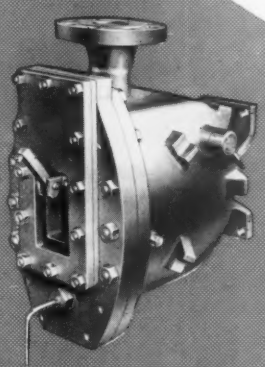
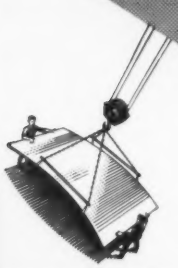


FIG. ST-9400
High pressure Gauge



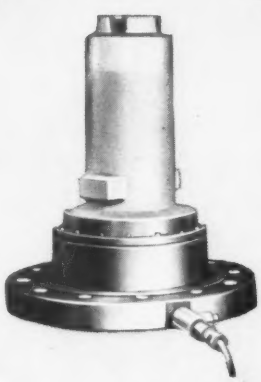


FIG. 13800
Hydraulic Valve

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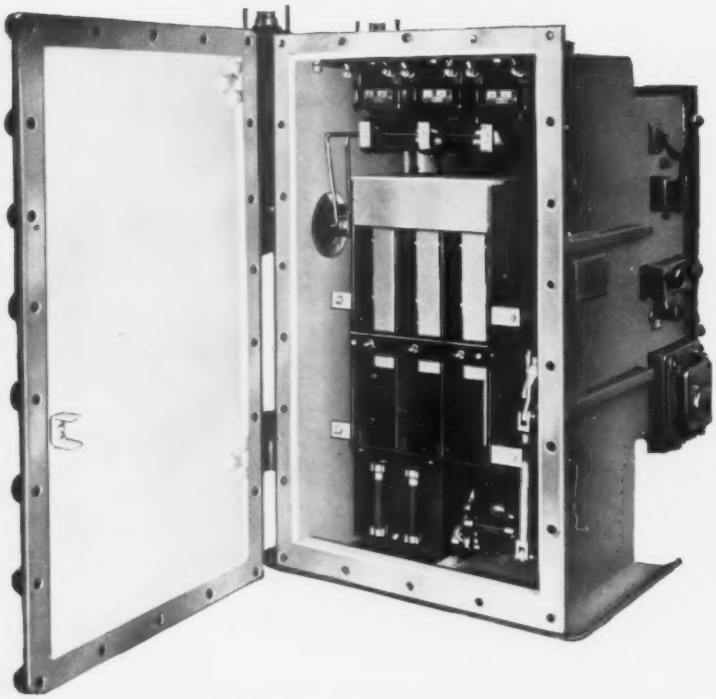

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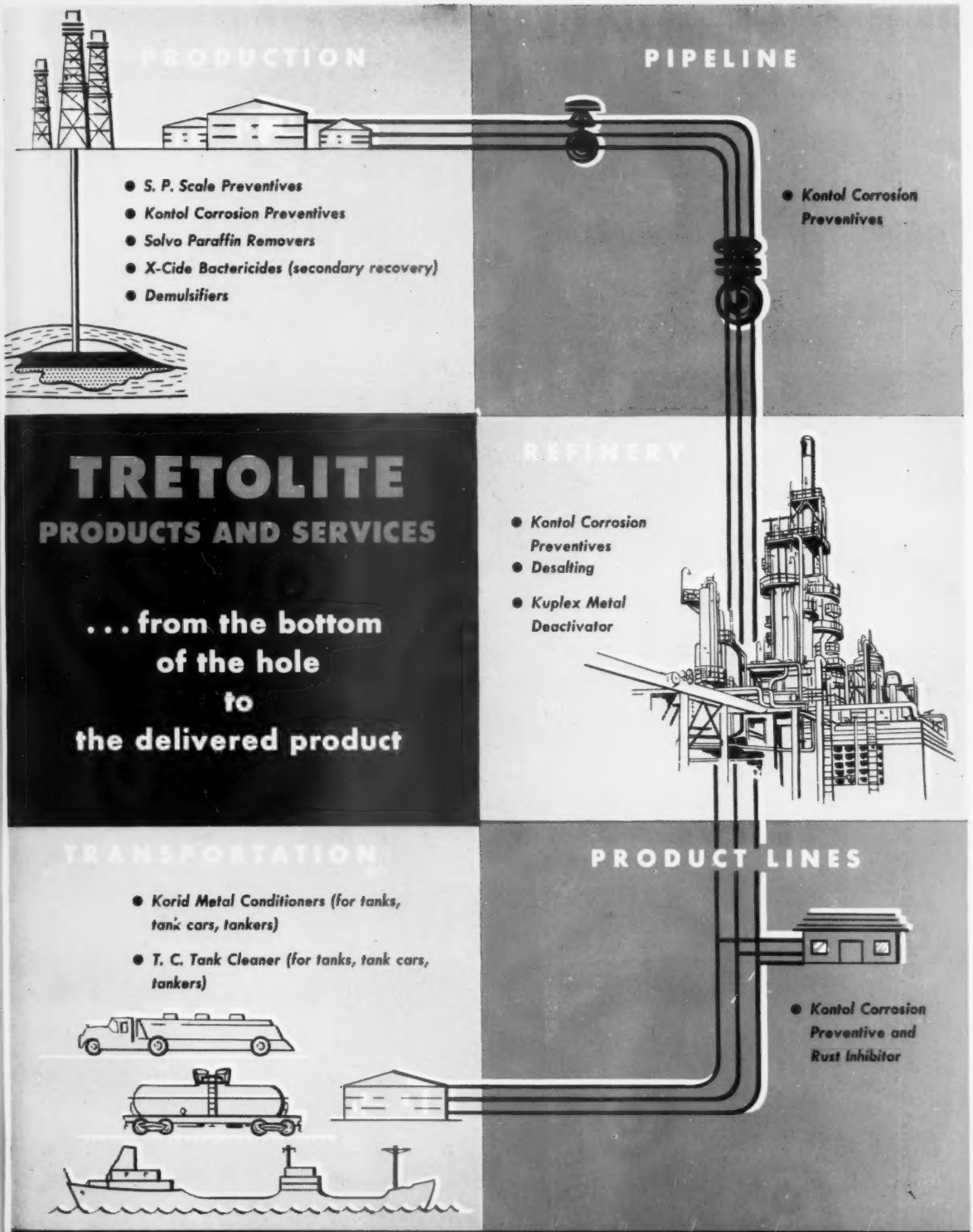

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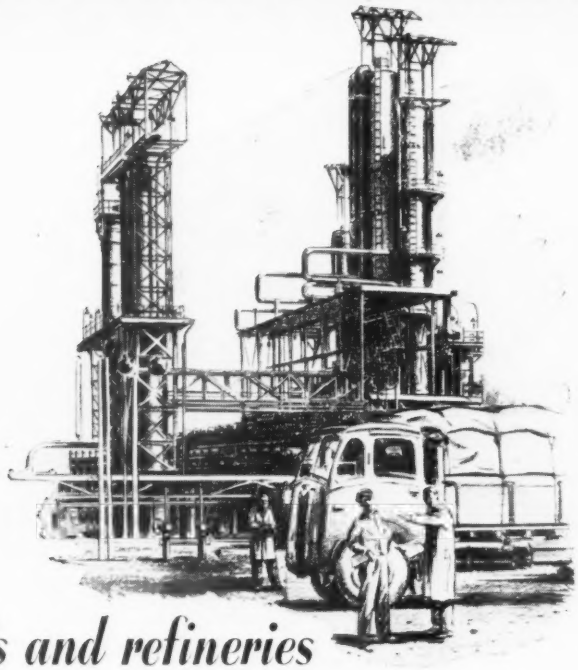

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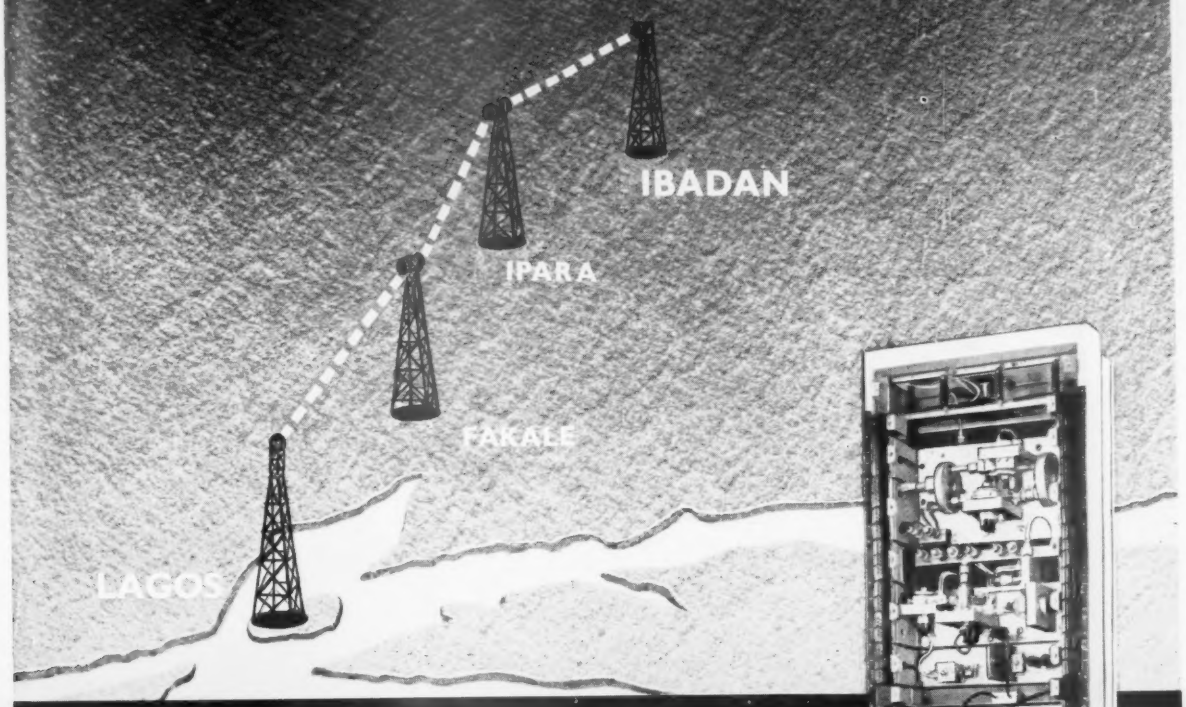

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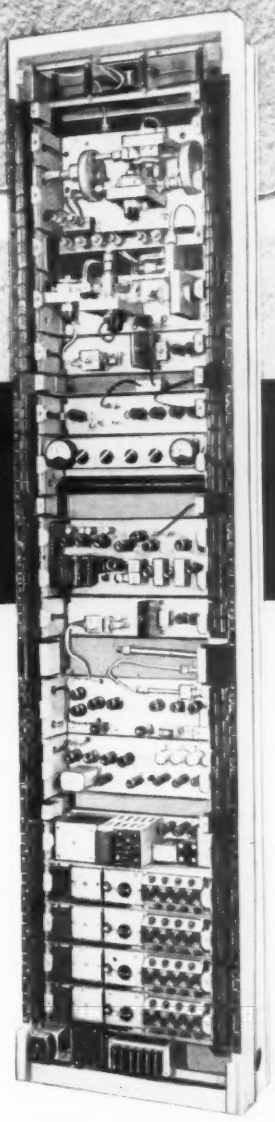

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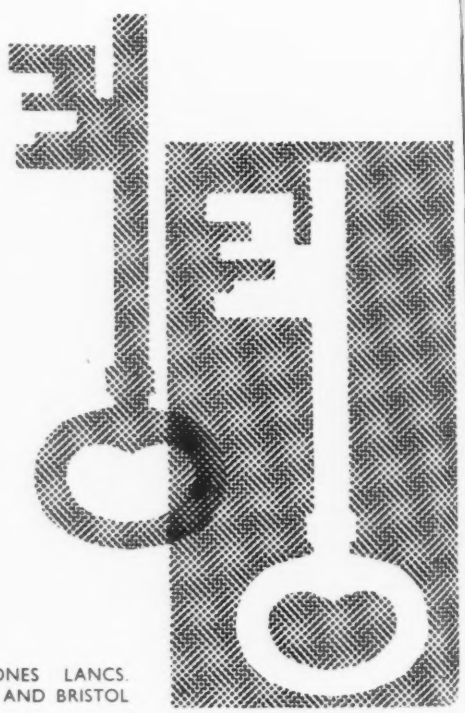

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*Pollution Abatement in the Petroleum Refining Industry**

By A. W. W. KIRBY†

In considering any particular aspect of pollution it is of importance to set it in perspective in relation to the more general problems. Atmospheric pollution is not new and can be said to have begun when man learnt to use fire, since the problems of atmospheric pollution to-day arise very largely, although not entirely, from man's need to burn something to obtain the energy that is required to sustain Britain's highly complicated civilized life.

In about A.D. 1260, Queen Eleanor, when staying in Nottingham while Henry III was leading an expedition to Wales, found the smoke from "sea-coale" was so bad that she was unable to remain and removed to Tutbury. At the end of the thirteenth century the burning of coal in London increased considerably and the smoke was especially noticed by visiting nobles and prelates attending Parliament. They led a demonstration and petitions against the nuisance supported by the public, and as a result there was a Royal Proclamation in 1306 prohibiting artificers from using sea-coale in their furnaces. The decree had little effect despite the execution of one offender.

In 1307, a Commission of Oyer and Terminer was appointed "to enquire of all who burnt sea-coale in the City or parts adjoining and to punish them for the first offence with great fines and ransoms and after the second offence to demolish their furnaces." In 1631, Howes wrote "Within the 30 years last the nice dames of London would not enter into any house or home where sea-coales were burnt and would not willingly eat of the meat that was either sod or roast with a coal fire."

The domestic fire is to-day responsible for about half the atmospheric pollution in Britain, but R. S. Scorer (*J. Inst. Fuel*, 1956, **29**, 143) gives an indication that, expressed in terms of cost to the community, pollution from the domestic fire is responsible for considerably more than half the cost of polluting the atmosphere. Scorer considers different classes of pollution sources, and weights the effects of pollution from them by consideration of various factors such as height and temperature of emission, bulk nature of the source, chemical nature of pollutants, proximity to site of damage, etc. Unfortunately, he leaps from this consideration to his conclusions without giving the details of his calculation, but if his results are accepted at their face value it is seen that the cost of damage done by domestic consumption amounts to £210 million per annum, or £6 worth of damage per ton of fuel consumed, whereas general industry only does damage to the extent of £7 million per annum or £0·16 worth of damage per ton of coal consumed.

It will be shown in this paper that the contribution of the petroleum refining industry to the pollution produced by general industry is relatively insignificant.

Atmospheric Pollution

There have been a number of attempts to control atmospheric pollution by legislation, starting in the fourteenth century. Various sections of the Public Health Acts have attempted from time to time to control emission of smoke, the enforcement of the law being in the hands of local authorities, usually the Public Health Inspector. But the first really effective Act of Parliament was the so-called Alkali etc. Works Regulation Act of 1863. This Act was brought into being to control the emissions of both sulphuric and hydrochloric acids from the manufacture of alkalis. It was brought up to date in 1906 and has several times been extended in scope. It is administered by the chief alkali inspector, who nowadays is responsible to the Minister of Housing and Local Government, assisted by a number of inspectors who look after different districts of Britain. The Act now covers most industrial processes that can give rise to emissions of noxious or offensive gases and, with a few exceptions where there are statutory obligations not to exceed maximum concentrations in the gases emitted, the Act requires that noxious or offensive gases shall not be emitted

* Paper read to IP Stanlow Branch on 19 December 1956.
† Shell Refining Co. Ltd.

and that the best practicable means shall be adopted to prevent their emission.

England is unique in having this Act, there being nothing quite comparable in any other country of the world, and the Alkali Inspectorate is not only an efficient body but very well qualified technically to secure the best administration of the Act while at the same time being most appreciative of the practical problems of industry.

Clean Air Act of 1956

A great deal of public attention was fixed on atmospheric pollution by the serious and extended fog that occurred in December 1952 in London, and which caused a marked increase in the normal death rate. Largely as a result of the public reaction to this, Parliament set up a Committee under the chairmanship of Sir Hugh Beaver to investigate the problem, which Committee published a report at the end of 1953 recommending considerable changes to the law. These recommendations have been implemented in the Clean Air Act of 1956. This Act is mainly directed at controlling the emission of smoke and grit, its main provisions affecting the petroleum industry being: discharges of dark smoke, *i.e.* smoke as dark or darker than Ringelmann 2, are prohibited; the best practicable means must be used to minimize emissions of grit and dust from furnaces. Smoke other than that from the chimney of a dwelling house and dark industrial smoke may be dealt with under the nuisance provisions of the Public Health Act of 1936. Whereas the Act is to be administered by local authorities, there is provision that in the case of premises controlled under the Alkali Act, the Clean Air Act shall be administered by the Alkali Inspectorate.

Emission of Grit and Dust

So far as the petroleum industry is concerned it makes virtually no contribution to atmospheric pollution by the emission of grit and dust, its sole contribution being the inevitable loss of catalyst powder fines from catalytic crackers. This emission, however, is insignificant because the catalyst regenerators from which the dust is emitted are equipped with cyclones to reduce catalyst losses and, as a result, only a small amount of extremely finely divided catalyst comes out with the flue gases from the regenerator stacks. This emission is so fine and of such low density and so finely dispersed by the height of the stacks and the temperature and velocity at which it is emitted that it is impossible to detect it as a deposition at ground level. To quote Rupert Brooke, it is "blown about the winds of the world and fades from brains of living men and dies, nothing remains."

Emission of Smoke

So far as the emission of smoke is concerned in the refining of petroleum, once again the industry can claim to be practically guiltless. This is because the furnaces of the plants in the refineries are efficiently designed and equipped with efficient burners and are normally working under very steady conditions. Thus, in spite of the fact that they may be fired on anything from hydrocarbon gases to asphalt itself, it is rare for furnaces to emit any smoke except under conditions of emergency or equipment failure when short bursts of smoke may be produced. Apart from process furnaces the most likely place within the refinery for the emission of dark smoke is the steam raising plant, where smoke may be produced by over-firing to satisfy an unexpected high demand for steam by the process plants. These bursts of smoke may be offences under the Clean Air Act and the way to avoid offences is, first, to give warning to the boilerhouse of increased demands for steam so that panic over-firing can be avoided; secondly, to install smoke recorders and alarms so that the boiler fireman may be immediately aware of the production of smoke; and, thirdly, to ensure that the boiler is properly equipped with the necessary CO_2 and oxygen recorders to enable the fireman to adjust his conditions to give efficient combustion in all circumstances at all times.

Flaring of Surplus Gas

One way in which the industry may be in danger of offending against the Clean Air Act arises from any smoke that may be produced in the flaring of surplus gas, particularly when there are large emergency quantities to be flared. There are, however, a number of techniques whereby flares can be rendered smokeless. One is by steam injection at the top of the flare stack, so arranged that the steam jet just impinges on the circumference of the stack at its mouth. A second method is to use a water spray instead of steam. Both of these methods are effective, partly by increasing the turbulence of the flame to gain additional admixture of air, and partly by the methane steam reaction. A third method is to use a series of giant bunsen burners which induce their own air supply. The burners are of different sizes and are cut in successively by pressure control.

Dispersion of Flue Gases

It is only when one considers the emission of noxious and offensive gases that one encounters the more serious problems of pollution in the industry, and to an enormous extent these problems arise from the sulphur content of crude petroleum. The simplest of them is concerned with the sulphur content of the fuel oils burnt in the refinery. Sulphur dioxide is produced in the flue gases and, particularly in refineries where high sulphur content asphalt is used as fuel, may give rise to flue gases with relatively high concentrations of sulphur dioxide up to 3 grains/cu. ft. Whereas it is doubtful whether there is any hazard to human health due to exposure to sulphur dioxide at the concentration produced by such flue gases at ground level after natural dispersion, it can be responsible for corrosion of both steel and stone work and can sometimes be toxic to vegetation. It is, therefore, necessary to ensure the most efficient practicable dispersion of the flue gases. This is done primarily by the use of high stacks and stacks of 200 or even 350 ft are not uncommon in the industry. A number of attempts have been made to remove sulphur dioxide from flue gases by washing the gases with river water containing suspended chalk, as at Bankside and Battersea Power Stations. Such a process can only be used where large quantities of water are available, and is quite expensive as the sulphur dioxide is not recovered. The Fulham Simon Carves process has been largely developed by the Fuel Research Station and entails washing the flue gases with ammonia liquor from gas works. It effects more than 90 per cent reduction in the SO_2 content of flue gases and the SO_2 is recovered as ammonium sulphate and sulphur, and is thus more attractive economically than the Battersea process.

The great disadvantage of any flue washing process stems from the great reduction in flue gas temperature. The efficient dispersion of flue gases is a function, *inter alia*, of the effective height of the stack, which is comprised of the actual stack height plus a component dependent upon the velocity of emission plus another component dependent

upon the temperature of emission. As an example, the stack of the cat cracker regenerator at a refinery in Australia is 140 ft high but the effective height of the stack calculated for a moderate wind velocity and mean meteorological conditions is 289 ft, because the additional plume rise due to velocity is 54 ft and that due to temperature is 95 ft.

Sulphur dioxide is also used in the industry as a solvent in lubricating oil refining in Edeleanu plants, and prevention of emission of SO_2 from this source is merely a matter of efficient maintenance and good housekeeping.

Sulphur from crude oil also figures in the problem in the form of H_2S. Sour crudes contain H_2S. H_2S is also produced during distillation by thermal decomposition of the high-molecular weight sulphur compounds and in significantly large quantities in catalytic cracking by the cracking of sulphur compounds. Furthermore, appreciable amounts of H_2S are produced in the hydrodesulphurization of middle distillates of high-sulphur content. The H_2S produced appears in a number of the products and its removal is, of course, essential. The removal is effected by regenerative processes. The Girbotol process using diethanolamine as the solvent is the one most commonly used. This process produces a stream of pure H_2S which is then fed to a Claus kiln for conversion to solid sulphur. SO_2 and H_2S are the only two noxious gases that are produced in the refining process in any significant quantity or concentration.

Malodour Problems

Apart from the foregoing, the major problems of atmospheric pollution in the industry lie in the suppression of odours that can be generated in the processes. Once again sulphur compounds are responsible for the majority of the odour problems. The steam used in the distillation processes condenses with the hydrocarbon vapours and dissolves some of the H_2S produced by incipient thermal decomposition. For corrosion protection of the plant, ammonia is injected into vapour lines where this occurs to neutralize the condensate, thus producing an aqueous stream which is separated from the condensed hydrocarbons and which contains ammonium sulphide. This malodorous water, together with similar water used in various washing processes, would give rise to odour problems if it were merely discharged to drain. The problem is solved by feeding the sour water to a stripping column in which the H_2S and any mercaptans present are stripped out by a combination of steam and flue gases. Also in some plants, particularly where spent soda solutions are combined with sour water, the sour feed to the column is simultaneously acidified and stripped with flue gases. The stripped sour gases from the water are destroyed by combustion in a process furnace. The stripped water, although not completely odourless, is so reduced in odour level that it can be discharged to drain without giving rise to an odour problem.

The mercaptan content of hydrocarbon fractions necessitates treatment of those fractions. In the case of the light gases this is effected by soda treatment, the spent soda being regenerated by steam which strips out the mercaptans which are subsequently burnt in process furnaces. In the case of gasoline, the mercaptans are either removed in a solutizer process or converted to the non-odorous disulphides in one of the many available sweetening processes, *e.g.* the doctor process. Solutizer solutions are regenerated and the removed mercaptans disposed of by burning. The doctor solution is regenerated by oxygen using air in the heated solution. This regeneration in some circumstances can give rise to a malodorous vent emission from the regeneration section of the plant but this is dealt with subsequently in the paper.

In the modern refinery using catalytic cracking, one of the most potentially odorous plants is the vacuum distillation unit that distils fuel oil to produce the heavy distillate feedstock for the catalytic cracker. The problem arises from incipient cracking at the necessary distillation temperatures which gives rise to small quantities of light distillates with a very high, heavy mercaptan content. Until recently, it had been the practice to obtain the vacuum on these units by steam ejectors and barometric condensers, the water effluent from which by contact with the light malodorous distillate acquires a powerful, persistent, and most unpleasant odour. The most effective way of curing this problem is to replace the barometric by surface condensers so that the smelly condensate never comes into contact with the cooling water which thus remains sweet; the condensate which will contain some water from the condensation of process steam can be segregated for disposal by burning or by return to crude.

Another problem of odour is found in the pumps which handle the liquid streams of light hydrocarbon gases before they have been sweetened. To minimize the problem, such pumps are equipped with mechanical seals, but in this service such seals are not always 100 per cent efficient. The failure of a seal can release into the atmosphere of the pumphouse large quantities of H_2S and for this reason such pumphouses are of open construction. In these circumstances, of course, spare pumps are commissioned immediately but a small leakage from the glands can give rise to a considerable odour problem and to overcome this the pumps in one refinery have had a system of ducts fitted over the glands, which system is evacuated by a blower via a caustic soda scrubbing column. The ideal solution of the problem is the use of glandless pumps in which both pumps and motor are enclosed in one casing. Such pumps are being developed by manufacturers, but as yet have not been produced in sizes big enough for this particular job.

It is now becoming standard practice to use floating roof tanks in all services involving volatile and sour crudes or products. This reduces nearly to nothing the evolution of vapours smelling either of H_2S or mercaptans, but where cone roof tanks are used for such products the evolution of vapours by tank filling or even by tank breathing can give rise to an odour problem. An effective but expensive way of curing this difficulty is by the installation of a vapour conservation system. A cheaper but less effective method is to use microballoons in cone roof tanks containing sour crudes. These microballoons are minute plastic spheroids which form a floating mat on the surface of the crude and reduce the evolution of vapours. Unfortunately, they are only of use with crudes and not with products and a disadvantage of their use is that the hydrocarbon vapour concentration in the vapour space may be reduced to a level within the explosive limits. For use in product tanks a plastic blanket, which floats on top of the liquid covering its surface, is on the market.

A potential source of malodour lies in relief valves on columns and pressure vessels. For this reason, such relief valves are connected into the flare system so that any malodorous releases are burnt.

Another source of odour arises from the spent sulphuric acid used in lubricating oil refining. At one time this was dealt with by burning the sludge but this gave rise to the emission of sulphur dioxide. A more modern technique is

to use a sludge decomposer plant and to convert the SO_2 released into sulphuric acid.

Another serious odour is found in the spent air used in bitumen blowing. For this reason, this spent air is piped to process furnaces so that the odour of heavy mercaptans and cracked products can be destroyed by burning. It is not a simple problem because there are large quantities of vapours to be dispersed, all of which have a significant calorific value which can upset temperature control in the furnaces. It is therefore necessary to pipe the spent air to sufficient furnaces to ensure that it can all be burnt under normal operating conditions.

In any plant as vast and complicated as a large modern oil refinery, there are a myriad potential sources of odour emission—from valve and pump gland leaks, manholes, dip hatches on tanks, and so on. For these reasons, it is essential that the standard of maintenance, housekeeping, and operational efficiency be kept as high as is humanly possible by constant vigilance and by the education of all operating staff.

Masking Compounds

A technique for odour abatement that has been tried in the industry with varying success is the use of masking compounds. Two of the major oil companies in the U.K. recently tried the use of such compounds with very limited or nil success, but recently a new range of compounds has been tried which differs from those tried previously in that the type of odour is diagnosed and an appropriate masking compound prescribed for each odour problem. There has been considerable success using this newer type of compound in masking the odour of water in an API oil separator. Other types of these compounds are being experimented with in other odour problems but it is as yet too early to make any statement. It is hoped that they may prove useful in masking the occasional odour emitted from doctor solution regeneration.

It is as well to make the point that with the introduction of crude refining into the U.K. on a major scale since the last war, there has been a good deal of complaint by the public against the odours of refineries. It is important that the public should realize that no matter how conscientious a refiner may be, it is impossible that a large modern refinery should ever be completely odour-free all the time. This has been recognized by the chief alkali inspector and he has said as much in his Annual Report to the Minister for 1951.

Los Angeles Smog

Before leaving the subject of atmospheric pollution, brief mention must be made of the smog phenomenon in Los Angeles on which a great deal of research work has been done and on which a lot of misguided and wild statements have been made. The current theory to account for the peculiar nature of the Los Angeles smog involves the production of ozone by the interaction of olefinic hydrocarbons and nitrogen oxides under the influence of sunlight, followed by hydrocarbon oxidation to yield aldehydes, etc. This theory may be correct, but its application outside Los Angeles is extremely doubtful. Few places in the world have the sunlight rates that Los Angeles enjoys, few places are a meteorological box enclosed by a permanent inversion and a ring of hills, and few places enjoy the high concentration of motor cars that exists in Los Angeles. This latter is important because whereas at one time the source of the hydrocarbons figuring in the Haagen-Smit reaction was thought to be vapour losses from refineries, current theory is that it is now to be found in unburnt hydrocarbons in automobile exhausts.

Water Pollution

Turning now to water pollution—there are two major statutory requirements. Those contained in the Rivers (Prevention of Pollution) Act and those in the Oil in Navigable Waters Act. Most of the refineries in the U.K. are fortunate in that they are situated on the coast and make their water discharges into estuarine or territorial waters and hence do not have to comply with the provisions of the Rivers Act. In one or two cases this is so and in order to meet the Act it is necessary to comply with standards laid down by the Rivers Board in granting permission for the discharge to be made to the river concerned. This Act is really only just beginning to get under way and Rivers Boards are inclined to be very stringent in the standards they demand.

Elimination of Oil from Effluent

So far as the Oil in Navigable Waters Act is concerned it is an offence to discharge any oil or any mixture of water containing any oil at all into territorial or inland navigable waters. This taken by itself would make it quite impossible to operate a refinery. For that reason a clause providing a defence was inserted into the Bill which was passed by Parliament in 1955 placing on a defendant the onus of proof that the effluent complained of arose from operations for the refining of oil, that there was no other place into which the discharge could be made, and that all reasonable practicable steps had been taken for eliminating oil from the effluent. Even this defence is invalidated if it can be proved that there has been actual fouling by oil of the surface of the water into which the discharge was made.

Oil is the most serious potential pollutant in the water effluent of refineries in the U.K., and except in cases where discharge is made to rivers and controlled under the Rivers (Prevention of Pollution) Act, other pollutants are only serious in the effect that they may have on oil separation. The classical method of oil removal is by gravity separators and the currently accepted design for them is laid down in the API Manual of Disposal of Refinery Wastes, Edition V. The principle of operation is that the separator enables an oil particle of specified dimensions, say 0·015 cm, to rise to the surface and there be trapped by a baffle. Successive changes of design of the API interceptor aimed at increasing its efficiency have made them expensive pieces of equipment and therefore it is desirable that the rate of intake should be kept as small as possible. For this reason water flows in a refinery should be divided into a number of streams. The perfectly clean cooling water used in tubulars which in normal circumstances does not contain oil at all should be kept separate from streams of water used either in processes or in barometric condensers which inevitably contain oil. The clean cooling water can be discharged without flowing through an API interceptor.

A third type of effluent stream should again be kept separate. All chemical streams such as deodorized spent sodas, soda naphthasulphonates, naphthenic acids, and, in fact, any stream containing an emulsifier, should be segregated for chemical treatment prior to joining the stream into the API separator. The type of treatment chosen for such streams depends on their nature and may involve acidification or some form of pH control, chemical flocculation alone, or combined with aeration. Biological treatment may also be

used and this type of treatment can be applied to effluents containing phenols and, in fact, is essential where discharges are made to clean rivers. Biological treatment has also been applied in a very simple fashion at one refinery for the destruction of naphthenic acids. It has been found that a 5 per cent addition of an effluent containing naphthenic acids to the domestic sewage fed to percolating filters achieves destruction of the naphthenic acids without any untoward effect upon the efficiency of sewage purification.

If it should become necessary to improve upon the effluent quality obtained by API gravity separation, as in America where discharges are made to rivers which may contain fish or may be used for potable water, after-treatment becomes essential by haybox filtration which is a messy business, or by flocculation and aeration, or by biological ponding.

Common Law Liability

Finally, it is as well to point out that while a refinery may comply with all the statutory provisions controlling its emissions into the air or water, the Common Law liability remains, and every person commits an indictable nuisance who does anything which endangers the lives, health, or property of the public. Under Common Law every person is entitled as against his neighbour to the comfortable, healthful enjoyment of the premises owned or occupied by him. This aspect of Common Law has become of particular importance in relation to water pollution. Leading cases have established that a riparian owner is entitled to have the water of the stream in its natural flow without sensible diminution or increase, or sensible alteration in its character or quality. Thus, while an industrial concern upstream of him may comply with Statutory Law in the effluent it discharges, Common Law may regard such effluent as polluting even though it meets statutory requirements. Similarly, a person or a local authority could obtain an injunction by Common Law against an industrialist whose atmospheric emissions comply with the Alkali Act, the Clean Air Act, or both.

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SUPER TANKERS FROM BRITISH YARDS

Sir Frederick Rebbeck, chairman of Harland and Wolff, speaking in Belfast at the luncheon following the launching of British Petroleum Company's new 32,000-ton tanker *British Honor* said that the Prime Minister's adviser on oil supplies, Sir Matthew Slattery, had approached him on the possibility of a 100,000-ton oil tanker being built in a British yard. Sir Frederick said that Harland and Wolff had given a good deal of thought to this matter and had informed Sir Matthew that they could see their way to help in building such a tanker fleet.

British Honour was sponsored by Mrs. Watkinson, wife of the Minister of Transport. Speaking also at the lunch N. A. Gass, chairman of British Petroleum Company, said that in regard to some Middle East oil areas, pipelines were at the moment the economic alternative to ships but were only an alternative. "It must not be forgotten" he said, "that the largest oilfields in the Middle East are in close proximity to the Persian Gulf." Although there was now a spell of surplus shipping and depressed freights, huge volumes of oil were being transported by sea every day. There was only a marginal surplus of tankers, and however distressing, that should not discourage or cloud the judgment to expand tanker fleets for future needs.

ENGINEERING AND THE PETROLEUM INDUSTRY

While it is true to say that progress in every field of engineering has had its effect on the development of the petroleum industry, it is equally true to say that the demands of the petroleum industry have played no small part in progress in the engineering fields.

When possible themes for the 1957 IP Summer Meeting were under consideration, the Papers Sub-Committee thought that the engineers might welcome an opportunity to speak of their achievements and to hear the views of the industry. The result was an interesting and valuable collection of papers, as follows:

Civil Engineering.	By A. C. Hartley, C.B.E.
Mechanical Engineering.	By E. J. Sturgess, C.B.E.
Electrical Engineering.	Part I by M. H. Lowson and Part II by S. W. J. Wallis.
Marine Engineering.	By G. Trypanis.
Metallurgy.	By Dr H. Harris.
Chemical Engineering.	By Prof F. H. Garner, O.B.E. and L. G. Miskin.

The seven papers, and full reports of the discussion which followed their presentation, are now available in book form. This book of 168 pages thus makes a valuable contribution to the literature on the petroleum industry. It covers every phase of the industry, from exploration to the distribution of the finished product, and contains much useful information of a general character.

Price of this book is £1 10s post free and to members of the IP £1 5s, remittance with order.

COUNCIL ELECTIONS 1958

Members are reminded that, under By-law 72, all nominations for the Council Elections in 1958 must be received by the General Secretary not later than 31 December 1957.

Applications must be made on the special Council Election form, proposed by a corporate member and supported by six corporate members. Forms are obtainable from the General Secretary.

FIFTH WORLD PETROLEUM CONGRESS

As already announced, the Fifth World Petroleum Congress will be held in New York during the first week of June 1959. A Papers Sub-Committee has been set up by the British National Committee to consider and select papers to be contributed from the United Kingdom.

The Congress will be organized in nine sections with an additional symposium on Applications of Atomic Energy to the Petroleum Industry. The headings of the nine sections are:

I Geology and Geophysics.
II Drilling and Production.
III Oil processes and refining.
IV Chemicals from petroleum and natural gas.
V Composition, analysis, and testing.
VI Utilization of petroleum products.
VII Engineering, equipment, and materials.
VIII Transportation, distribution, and marketing.
IX Operations, research, statistics, and education.

Those wishing to submit papers for consideration by the Papers Sub-Committee are requested to forward details of title and author, together with a short synopsis of the paper, to the Editor, The Institute of Petroleum, 26 Portland Place, London, W.1, not later than 30 November. The number of papers which can be accepted for the Congress is limited.

Around the Branches

BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD

The 164th General Meeting of the Branch was held at the Apex Club, Trinidad, on 28 June, when F. D. Edwards, technical superintendent, and L. Hawkins, process engineer, of the Trinidad Oil Co. Ltd, presented a paper entitled "The Hydraulics of Long Distance Pipeline Design". In the absence of H. C. Costelloe, who was on long leave in the U.K., the chair was taken by Dr A. L. Down.

After introducing the basic hydraulic principles involved, the paper dealt mainly with the application of the modular method for the design of long-distance pipeline systems. The method, which involved the use of profiles prepared from contour maps of the route, hydraulic triangles based on the various pump and pipeline alternatives, and quantity and characteristics of the liquid to be pumped, was applied in detail to a specific problem. Emphasis was given to the economic sizing of lines and pumps, and lantern slides illustrated the various possible alternatives of equipment for a given system. Tables were shown of cost data governing the final choice of a design for optimum capital outlay and operating costs. An interesting discussion followed during which many questions were asked dealing with the practical applications and limitations of the method.

The meeting was well attended, invitations having been extended to the Joint Overseas Group of the Institutions of Civil, Mechanical, and Electrical Engineers. A vote of thanks was proposed by D. P. J. Holbrook who was there in the dual capacity of a member of the Branch and also Honorary Secretary of the Joint Overseas Group of the Engineering Institutions.

Survey Vessel Visited

On 1 September, a party of 21 members of the Branch visited the Royal Navy survey vessel, H.M.S. *Vidal*, which anchored at Trinidad during the course of a survey assignment in the Caribbean, with the object of bringing the Admiralty charts up-to-date.

H.M.S. *Vidal* is a modern survey vessel, launched in 1951 and equipped with the most up-to-date survey equipment, including Two-Range Decca radio location system, radar, and echo sounding apparatus. The accommodation and working quarters are air-conditioned throughout.

The party were met aboard by Lt-Cdrs Haslam and Price, who conducted the party around the ship. Starting in the Chart Room, Capt. Irving outlined the history and mode of operation of the Royal Navy's survey unit. He then went on to describe briefly the modern survey methods in use, showing how data collected were computed and plotted on working charts. These working charts were later returned to the Naval and Hydrographic Office for incorporation in standard Admiralty charts. Examples of the various draughting stages were seen, including original drawings, copper engravings, and zinc litho sheets. Echo-sounding charts were examined. In addition, equipment was available for taking bottom-core samples, water temperature, and for water sampling at various depths.

The party then proceeded to the bridge, where the echo-sounding equipment and Two-Range Decca equipment was demonstrated. Moving forward, it examined the winch assemblies for the wire-line depth sounding, water temperature surveys, and bottom coring.

A two-seater helicopter, accommodated in a hangar aft of the smoke stack, which is used for spotting shoals and for aerial photography, completed the survey equipment.

The programme of work on which H.M.S. *Vidal* was engaged has also taken her to the Bahamas, Jamaica, and British Honduras. Surveys around Trinidad, Tobago, Grenada, and Barbados will complete her work for this year.

The tour of inspection completed, the party repaired to the Ward Room where traditional Naval hospitality was dispensed. On behalf of the Branch, a hearty vote of thanks was proposed by Dr A. L. Down.

H.M.S. Vidal *which was visited by members of the Trinidad Branch during her stay in Trinidad.*

Personal Notes

R. Tourret B.Sc.(Eng.), A.M.I.Mech.E., A.F.R.Ae.S., A.F.Inst.Pet. left the Admiralty Oil Laboratory, Brentford, to take up a post with Esso Research Ltd at Abingdon on 1 November 1957. While at A.O.L., Mr Tourret was in charge of all the engineering activities of the establishment, including work on diesel lubricating oils, gear oils, diesel fuels, greases, hydraulic oils, etc.

Frederick E. C. Jenkins, B.S., from the St. Louis office of the Tretolite Company has been transferred to the Company's office in The Hague. There he will be technical service engineer specializing in demulsifiers and corrosion inhibitors throughout Europe and the Middle East.

R. T. W. Hall, B.Sc., Ph.D., A.F.Inst.Pet., has recently been appointed chief chemist at Fawley refinery.

J. W. Lowdon, B.Sc., M.I.C.E., F.Inst.Pet., until recently chief engineer of the Kuwait Oil Co. Ltd in Kuwait, has now joined the staff of the International Bank for Reconstruction and Development (the "World Bank"), in Washington, D.C.

Bryce Cousens, manager of Mobil Oil Company's Western Automotive Division since its formation two years ago, has resigned from the Company to take up an executive appointment with The Standard Motor Co. Ltd. He has been succeeded by **G. B. Reid,** previously district manager in Mobil's Southern Automotive Division in London.

G. B. Reid

Adrian Wood, who is 18 years of age, is this year's winner of the Shell Photographic Training Scholarship, which is offered annually to students from schools of photography in the U.K.

A. Wood

For his "seamanship and courage" in manoeuvring a tanker in the stormy Atlantic approaches last winter in order to help a disabled Finnish steamer, **Capt. Clifton James Hedges,** M.B.E., of the Shell Tanker fleet, has been made a Knight of the Order of the White Rose of Finland.

The Order, awarded to Capt. Hedges by Dr U. Kekkonen, the Finnish President, was presented by the Counsellor of the Finnish Embassy, R. Solanko, at a ceremony held at the Finnish Embassy in London.

In the report by the Master of the disabled vessel, the 4000-ton s.s. *Petsamo*, it was stated that the Shell tanker *Harpula* (17,988 dw tons), then under the command of Capt. Hedges, was 100 miles away when the Finnish ship sought aid on 14 December 1956 in a violent storm off the south-west coast of Ireland. The *Petsamo's* steering gear was, she reported, disabled and the situation of the ship "critical." The *Harpula* responded to her call and for 20 hours delayed her voyage, circling the *Petsamo* and offering her protection from the worst of the gale while the Finnish crew carried out repairs to their ship. The *Harpula's* action had a "decisive effect", added the report, and next day the *Petsamo* was able to continue her voyage.

Captain Hedges receiving the Order of the White Rose of Finland from R. Solanko, Counsellor of the Finnish Embassy in London. Mrs Hedges accompanied Capt. Hedges

General Refractories' Appointments

Eric C. S. Greaves, who has been in the Company's service for 26 years and has for some years been North Western Area sales manager, has been appointed to the position of Home sales manager.

E. C. Brampton, who has held a senior position in the Technical Service Division of the Company for 17 years, has been appointed North Western Area manager in succession to Mr Greaves.

G. G. Abraham, hitherto North Eastern Area sales manager, has been appointed to the position of Technical Service manager at Head Office.

John G. Watson, has been appointed to the position of North Eastern Area sales manager in succession to Mr Abraham.

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Fina Petroleum Products Ltd

On 1 October the name of Fina Petroleum Products Ltd was changed to Petrofina (Gt. Britain) Ltd. The brand name of the Company's products will still be "Fina". The announcement states that the new name will serve as an assurance that the Company has behind it the resources of the Petrofina Group which cover all aspects of the petroleum industry.

Colonel S. J. M. Auld, O.B.E., M.C., D.Sc.

Presentation of Institute Awards

E. B. Evans, M.Sc., Ph.D.

Members of the Institute gathered in force in the Lecture Theatre at 26 Portland Place on 2 October to witness a very pleasing function. It was the occasion of the presentation of two well-earned awards—the Honorary Fellowship to Colonel S. J. M. Auld, O.B.E., M.C., D.Sc., and the Eastlake Medal to E. B. Evans, M.Sc., Ph.D.

The Presentation to Colonel Auld

In presenting the Honorary Fellowship to Colonel Auld, the President, the **Right Honorable Lord Geddes** said that Colonel Auld had twice occupied the president's chair in the Institute, first for the period 1937 to 1939, and then for the period 1954 to 1956. He was also a vice-president for 1935-37, and had been on Council continuously since 1932. The Council committees on which he had served read like an organization chart of the Institute, for they included the House, Finance, Research, Standardization, Awards, Election, Engineering, and Publications committees.

Colonel Auld joined the Anglo-Persian Oil Company in 1919 and after spending nine years in Persia and Burma on field refinery work, he joined the Vacuum Oil Company and was then for eighteen years with that company and with the Socony-Vacuum Oil Co. Inc. In 1946, he retired from the position of chief technologist in the Vacuum Oil Company and took on consulting work; he was also a director of the American Locomotive Export Company and other concerns. During the 1914 to 1918 war, Colonel Auld was technical adviser to the Third Army, and commanded the British Gas Warfare Commission to the United States. He also served in the American Army and was awarded the American Distinguished Service Medal. In the second world war he was adviser on flame projectors in the Petroleum Warfare Department. He was also technical adviser to the Petroleum Board, and chairman of the technical committee of the Lubricating Oil Pool, as well as being chairman of the Technical Sub-Committee of the War Cabinet Committee, and of the Engine Oils and Fuels Committee.

A catalogue of service like that, said the President, must be almost unique, and it was with very great pleasure that he had the privilege of offering Colonel Auld the Honorary Fellowship of the Institute of Petroleum.

Colonel S. J. M. Auld, accepting the award, said that he felt greatly honoured by the award of the Honorary Fellowship and by the nice things which the President had said in making the presentation. He had also been particularly gratified by the congratulatory messages he had received from members of the Institute since the announcement of the award.

If he had achieved anything for the Institute at all, said Colonel Auld, in the matters of the broadening of its basis and of its expansion, it had been a work of love and consequently had already been awarded in its own self. This work, which was now being carried forward by the President, was really the carrying of a torch which had been lit and carried by such personal friends as Lord Greenway, Dr A. E. Dunstan, Lord Cadman, Elliot Evans, C. A. P. Southwell, and Sir Stephen Gibson.

He concluded by again thanking the President and the Council and the members of the Institute for their having so honoured him.

At the Council Dinner following the presentations: H. Hyams (an Eastlake Medalist), Col S. J. M. Auld, the Rt Hon. Lord Geddes (President), Dr E. B. Evans, T. Dewhurst (a past-president)

The Award to Dr E. B. Evans

Inviting Dr E. B. Evans to accept the Eastlake Medal of the Institute, which is awarded for long and meritorious service to the Institute, **the President** said that Dr Evans again had a catalogue of service and achievement in the Institute which was formidable. Suffice it to say that having joined the Institute in 1928, he had been a member of Council since 1939 (eighteen years), and a vice-president during the periods 1948-50, 1951-4, and 1955 to date. Dr Evans, as they knew had concentrated very largely on the publications work of the Institute, and indeed there was much of that work for which they had entirely to thank him. He was a member of the Permanent Council of the World Petroleum Congress, and there again a most important one, and one upon whom great reliance was placed and who carried an appreciable part of the load. He was a member of the BSI petroleum industry committee, and a member of the Council of the British Flame Research Committee, and he had the remarkable achievement of being author or part-author of some thirty papers on hydrocarbon chemistry, viscosity, engine knock, and other branches of petroleum science. He joined the old Anglo-American Oil Company, (now Esso Petroleum Company) in 1926, and was seconded to the Petroleum Board for the period 1939 to 1945. He was now chief chemist of Esso Research Limited.

The President then said that it was with very great pleasure that he presented to him the Eastlake Medal in thanks for all he had done for the Institute.

Dr E. B. Evans, in accepting the Medal, said he would like to thank the Council and the members very sincerely for the honour they had done him in awarding him that very valued medal. He also thanked the President for the very kind things which he had said.

He very much appreciated the medal, which commemorated one of the founders of the Institute.

He joined the Institute, as Lord Geddes had said, in 1928, and first became connected with its work in about 1931. Then he made his first association with the Publications Committee which had, in more recent years, been perhaps his main interest, by becoming an abstractor.

However, said Dr Evans, in those days he had not thought that he would one day become chairman of the Publications Committee, and follow in the footsteps of the three men who had done so much to establish the reputation of the Institute as a publishing body. He referred to W. H. Dalton, Dr A. E. Dunstan, and Professor F. H. Garner. He assured them he had derived much pleasure from his work for the Institute not only in the sharing of the co-operative effort, but more particularly in the large number of very real friendships which one made in the course of being associated with work of that kind.

He would like to feel also, said Dr Evans, that in awarding him the medal, the Institute recognized in some way the work of the whole publications team. It was a very large team, a very happy one, and a very co-operative one, and he paid tribute to all those members, past and present, who had helped in the work of the Publications Committee and its sub-committees. They also owed a tremendous debt to all those who wrote, who abstracted, who reviewed books, who refereed papers, and who helped in a myriad ways, to maintain the standard of the Institute's publications.

Colonel Auld signs the Book of Honour and

Dr E. B. Evans receives the Medal from the President.

Notes of the Month

New Type Boiler at Stanlow

During the recent (routine) shutdown of the catalytic cracking unit at Shell's Stanlow refinery, engineers installed a special boiler for raising steam, the first of its kind in the United Kingdom.

Instead of conventional fuel, this boiler uses mainly gases from the catalytic cracking unit which formerly were discharged to atmosphere. Resulting from regeneration of the catalyst used in the catalytic cracking process, these gases, in addition to being at an already high temperature, are also combusted in a suitably designed burner to give more heat; the combined heat from both these sources is used to raise steam in the new boiler. Designed by Shell technologists, the boiler was constructed by John Thompson of Wolverhampton.

The gases are led from the top of the catalytic cracking unit, which is over 200 feet high, by a duct 5 feet in diameter specially designed to withstand high temperatures and erosion resulting from the small catalyst particles in the gas stream. The tying-in of this new boiler has altered the well-known appearance of the catalytic cracking unit at Stanlow refinery. A new gleaming pipe now connects the cat cracker to the steam boiler, replacing the familiar tall single stack.

The operation of the new unit will result in an estimated saving of the equivalent of 30,000–40,000 tons per annum of heavy fuel.

New Tanker Jetty at Finnart

The first steel piles have been driven for a new tanker jetty being built by BP at Finnart, on Loch Long, Scotland. When completed in the autumn of 1958, the jetty will accommodate any one of the largest tankers now under construction.

The new jetty which is about half a mile south of BP's present tanker jetty and installation, will have two shore arms each 180 feet long. One arm will carry a roadway for light vehicles and the other a pipe-track. The jetty head, at which there will be a low water depth of 55 feet, will be 330 feet long.

Tankers will be able to discharge up to 6000 tons an hour of crude oil through two 24-inch pipelines, connecting with four new storage tanks now being built and the four tanks at the present installation. All these tanks will be linked through the existing pump-house to the 57-mile pipeline to BP's Grangemouth refinery.

It was announced earlier this year that the annual processing capacity of Grangemouth refinery is to be raised from 2,200,000 tons to 3,100,000 tons. This increased capacity will be close to the annual carrying capacity of the Finnart pipeline.

Kent Refinery Expansion

The new distillation unit, which will increase the annual capacity of BP's Kent refinery from 4,600,000 tons to over 7 million tons, is now more than half-way to completion. The steel cap on the 150 feet high secondary column of the unit has been lifted into position and work is well advanced on the internal fittings of both the primary and secondary columns which form the heart of the distillation unit.

The first unit to be completed in the expansion programme will be a hydrofiner for the production of low sulphur diesel oil. This unit will be closely followed by the new distillation unit, together with a stabilizer unit and other ancillary plants. This £30 million project also includes units for the production of aviation gasoline, extensions to the boiler and power plant, two new jetties on the Medway, and a considerable number of new storage tanks. It is expected that the whole project will be completed during the early part of 1958.

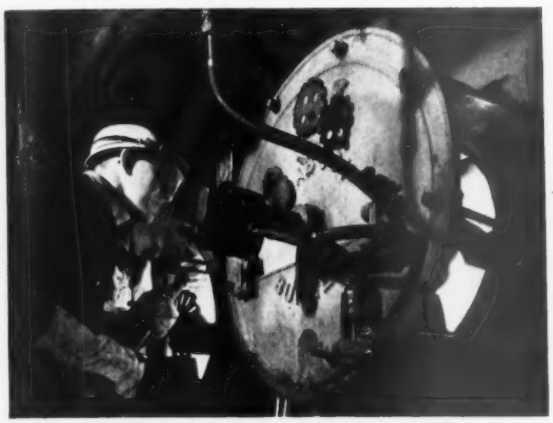
Submarine Tanker Tests

Writing in the September issue of *Impulse*, W. A. Crago, who is in charge of hydro-dynamic model testing for Saunders-Roe Ltd, states that Mitchell Engineering Ltd has initiated tests to establish that high-speed submarine tankers, as big as 100,000 tons, could form an economic means of transportation.

Eight models will be used for the tests, which will be carried out in the Saunders-Roe Number One Towing Tank. The models will be of simple body shape, but of varying design parameters, so that major hydro-dynamic characteristics can be systematically varied. They will be towed over a range of speeds and draught conditions and turbulent flow will be stimulated.

Awards for Shell Photographer

E. Willmott, A.I.B.P., A.R.P.S., of the Shell Photographic Unit, gained both awards of merit in the colour section of this year's National Exhibition of the Institute of British Photographers. The winning colour print was taken at the Egham Technical Service Laboratory and showed a two roll mixing wheel for plastics. The winning colour transparency, a black and white copy of which is reproduced here, shows an operator changing a burner on heaters at one of the distillation units in the Company's Stanlow refinery.



The Exhibition covered many fields of professional photography and a considerable proportion dealt with industrial subjects intended for advertising or industrial purposes. Mr Willmott commenced his training with the Shell Photographic Unit in 1948 and has recently been on extensive assignments in the Persian Gulf, in Uganda, and in West Africa.

The British Computer Society

It was announced recently that Dr M. V. Wilkes, F.R.S., had accepted an invitation to become the first President of the Society, and that an interesting series of papers and discussions had been arranged for the 1957–8 session.

Application for membership of the Society, which is open to anyone who has an interest in the use of electronic computers and computing techniques, should be made to the Secretary at 29 Bury Street, St. James's, London, S.W.1.

N.I.F.E.S. Maintains Its Progress

Sponsored by the National Coal Board, the Central Electricity Authority, The Gas Council, Shell-Mex and B.P. Ltd, Esso Petroleum Co. Ltd, and the South of Scotland Electricity Board, The National Industrial Fuel Efficiency Service (N.I.F.E.S.) is an independent non-profit making company which has made remarkable progress since its inception three years ago.

In its *Third Progress Survey with Report and Accounts*, for the period 1 April 1956 to 31 March 1957, it is reported that expansion in the main services was 37·5 per cent higher than in the previous year. Many interesting examples are given of the way in which the Service has assisted numerous facets of British industry with fuel efficiency problems. The Survey also shows that savings, which overall amount to over 18 per cent of total fuel consumption, are being secured in all sections of industry, and in firms both large and small.

Petroleum Chemical Company Formed in Germany

A joint company, Erdoelchemie G.m.b.H., has been established by Farbenfabriken Bayer Leverkusen Ltd and BP's German associate, BP Benzin und Petroleum A.G., for the manufacture of petroleum chemicals. The company's office will be at Leverkusen, Germany, and a factory, which is expected to reach the first stage of completion by the end of 1958, is being built at Dormagen.

The initial capital of the new company is DM 50,000, in which Bayer and BP each have a 50 per cent share. The capital will be increased in due course; present plans provide for a total expenditure of about DM 240 million (£20 million).

Liquefied Natural Gas Imports

Speaking at the recent annual meeting of the Scottish Association of Gas Managers, Sir Harold Smith, chairman of The Gas Council, referred to the possibility of importing liquefied natural gas from Venezuela and from the Middle East. He said that he hoped it would not be long before the first experimental ship came across the Atlantic carrying liquefied natural gas. If the experiment was successful it should be followed by large-scale importation of liquid natural gas, and the price at which it could be imported should be considerably lower than the price at which it could be manufactured.

Mobil Training Centre at Denham

A new Retail Training Centre has been opened by the Mobil Oil Co. Ltd at the Flying Red Horse Service Station, Denham, Bucks. At the opening ceremony, F. Barribal, a director of Mobil, said that the new station had been built to enable the company to gain first-hand experience of the retail trade. New equipment and new methods would be tried out so that the company could then advise and assist in the ultimate aim of friendly service at Mobilgas stations. The new service station is in two units—the Retail Training Centre and the Service Station itself. The Centre, which will be the headquarters of Mobil's retail training in the U.K., has a lecture room and training equipment, including films, projectors, sound recorders, and other special training aids. The training service bay is on the ground floor and it is here that new prototype equipment will be tested.

The service station building has lubrication and wash bays, an accessories sales room, oil storage facilities, staff room, customer toilets, and so on.

The Flying Red Horse Service Station, Denham—H.Q. of Mobil's Retail Training Centre.

British Vigilance *awaiting the official Trials Party.*

On Trial

A Tanker Shows her Paces

Keel laid, 11 June 1956; launched, 20 December 1956; sea trials 19-20 May 1957; taken over, 21 May 1957. So reads the history of *British Vigilance*, a 16,000-dw ton tanker built by Sir James Laing & Sons Ltd at their Deptford Yard, Sunderland. In this article we are concerned with that operation about which so little is written—the sea trials—and at which we were privileged to be included in the official Trials Party.

Sea trials is the time at which not only the ship, but all its operating and ancillary equipment is put to the most rigid tests before the owners take delivery. Consequently, when she leaves the yard but still in the hands of the builders, the ship carries a host of personnel, including the Captain, officers, and some of the technicians who will be in her complement; representatives of the builders and of the various sub-contractors; representatives of the engine builders and their sub-contractors; and a considerable number of workmen.

The Ship

British Vigilance, the BP tanker whose acceptance trials are here described, is the last 16,000-dw ton tanker of a programme of twelve similar ships, her principal details being:

Length overall	547 ft 0 in.
Length between perpendiculars	515 ft 0 in.
Breadth moulded	69 ft 6 in.
Depth moulded	37 ft 6 in.
Summer displacement ...	22,500 tons approx.
Deadweight at 30 ft draught ...	16,000 tons approx.
Gross tonnage	11,350 tons
Service speed, loaded	$13\frac{3}{4}$ knots

Engines—The single screw is driven by a 6-cyl N.E.M. Doxford 67 LBD 6 marine oil engine, each cylinder being 670 mm bore by 2320 mm combined stroke, diaphragm type. The engine was built and installed by The North Eastern Marine Engineering Co. (1938) Ltd, and develops 6800 max b.h.p. at 119 rev/min and 6400 service b.h.p. at 115 rev/min.

Crew and Accommodation—Accommodation is available for the Master, 3 deck officers, 4 navigating apprentices, 8 engineer officers, 2 engineer apprentices, chief steward, radio officer, and 35 petty officers and ratings, a total of 55. All except apprentices and boys are provided with single cabins, the accommodation for officers and apprentices being located amidships and the remainder aft.

The Acceptance Trials

The vessel left the yard shortly before 6 p.m. on the evening of 19 May, having first tested steering gear, engine-room telegraph, and siren. Once clear of the River Wear, ballasting commenced, and while this was in progress the acceptance trials were started. First, compass adjustment was carried out, this operation occupying about one hour.

The next step was to test the anchor gear, and for this one length of cable on each side was hove-in separately, then both port and starboard together, and finally four lengths of cable were hove-in on both sides and the anchors housed. Times for these operations varied from 1 min 55 sec for the heaving-in of one cable length to 11 min 30 sec for the final operation.

Engine Tests

On completion of the anchor trials, the starting characteristics of the main engine were examined. This required 12

starts, 6 ahead and 6 astern being obtained on one tank with a fall in pressure from 580 p.s.i. to 340 p.s.i.

When ballasting was completed to summer marks, and during night time to facilitate observations of illuminated shore marks, the measured mile trials were carried out. These consisted of six runs, two in each direction at 3500 b.h.p., two at 5300 b.h.p., and two at 6700 b.h.p.

The mean figures recorded for the six runs were:

Runs	*Rev/min*	*I.h.p.*	*B.h.p.*	*Speed, knots*
1 and 2	95·7	4389	3560	12·84
3 and 4	108·6	6428	5355	14·47
5 and 6	116·7	7893	6700	15·33

Speed trials finished, the main engine exhaust gases were diverted to the auxiliary boilers and steaming by this system was found to be satisfactory.

Completion of the speed trials marked the end of that part of the operations and the ship proceeded to the Tyne to await the Official Trials Party.

It was a grey morning, with a drizzle of rain and a swell on the sea as the tug carrying the party, who incidentally had already signed on as "ships' crew" to meet the Board of Trade regulations, made its way to *British Vigilance*. Some of those in the party, not used to boarding ships at sea, had some doubts of their agility but all were soon safely on the tanker.

The vessel then proceeded on its way and, when the speed of the engines had reached 100 rev/min, the engine tests continued. These next tests were concerned with the use of the Nemstop gear for stopping main engines designed by the North Eastern Marine Engineering Co. Ltd. The results of these tests at the engine speed of about 110 rev/min and ship's speed about $14\frac{3}{4}$ knots were:

1. *Normal stop without Nemstop:*
   Time to stop engine ... 4 min 18 sec
   Time to go astern ... 4 min 18 sec

2. *Stop using single-stage Nemstop:*
   Time to stop engine ... 2 min 5 sec
   Time to go astern ... 2 min 5 sec

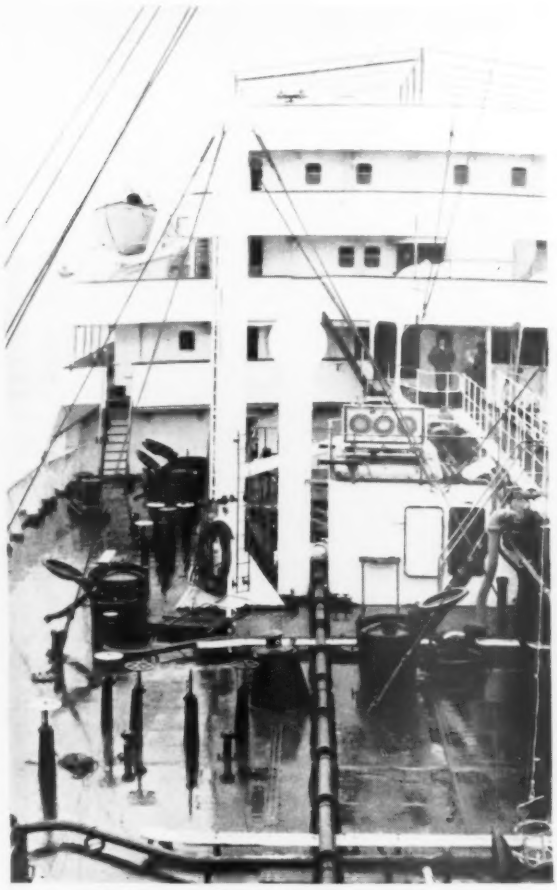
3. *Stop using two-stage Nemstop:*
   Time to stop engine ... 1 min 10 sec
   Time to go astern ... 1 min 25 sec
   Time to ship dead in water ... ... 7 min 10 sec
   Time from 86 rev/min astern to start ahead... 15 sec

Steering Trials

When at suitable draught and with the engines running at not less than 100 rev/min, various rudder movements were carried out and timed, both from the bridge control position and from the after boat deck control position. These movements, and their timings, were:

	Bridge sec	*Boat deck sec*
Midships to 35 deg starboard ...	21	15
35 deg starboard to 35 deg port ...	27	23
35 deg port to 35 deg starboard ...	25	25
35 deg starboard to midships ...	12	19

Later, the turning circle tests were made, the ship making two complete circles, one on the port helm and one on the



A general view on British Vigilance *during the trials.*

Ballast being discharged during the pumping trials.

A tanker on trial making a turning circle.

starboard helm with the rudder hard over and engine at about 100 rev/min. The time for the starboard circle was 8 min 25 sec and for the port circle, 8 min 16 sec. Diameter of the circle was about 4 cables, or 0·4 mile.

Pump Trials

The operation of deballasting provided a means of carrying out two full-scale pumping tests, each test occupying one hour. During the first of these, the weight of ballast discharged was 1982 tons. Steam pressure was 140 p.s.i. at boilers, 116 p.s.i. at the after pump room, and 105 p.s.i. at the forward pump room.

In the second test the quantity discharged was 1691 tons, steam pressure being 140 p.s.i. at boilers and 85 p.s.i. at the forward pump room. Other measurements as necessary were made during these tests.

Miscellaneous Items

While the trials of main equipment were in progress, there was considerable activity elsewhere in the ship while navigation and other equipment was put through its paces and adjusted where necessary.

Thus, the radio officer was busy making sure that equipment which would be his responsibility was in perfect order. Similarly, the makers of the radar equipment were making last-minute adjustments, the accuracy of direction-finding and similar instruments were checked and re-checked, and all over the ship men were busy with their own particular job of ensuring that all was as it should be.

Handed Over

The trials completed to the satisfaction of all concerned, and all ballast discharged, the vessel made its way back to the Wear to berth alongside the quay for the final clean-up prior to being officially taken over by the owners. Hardly had the gangway touched the quay, when workmen went on board to put the final touches to paint-work, etc.

The vessel was taken over by her owners—BP Tanker Company Ltd—on 21 May, registration formalities were completed and crew signed-on, and she sailed from Sunderland on the following morning. Her first cargo was loaded at Aden—a full cargo of motor spirit for north-west Europe.

THE NEMSTOP GEAR

The Nemstop gear referred to above has been designed by the North Eastern Marine Engineering Co. Ltd and consists of a cylinder relief and de-compression valve, the operation of which applies a braking effect to the engine.

The valve, for which a patent has been granted, is illustrated in Fig 1 and its operation is described in relation to Fig 2. With the Nemstop lever in the inboard position, all relief valves are shut and function normally.

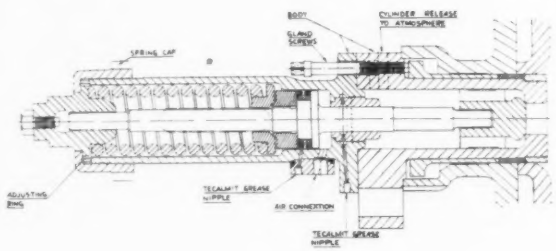


Fig 1

Captain C. Colburn watches the trials with considerable interest.

British Vigilance *was the first of its size to be built for BP by Sir James Laing & Sons Ltd, whose managing director, A. J. Marr, is seen here on the bridge.*

Single-stage Operation

With the fuel shut off, the lever is placed in the outboard position and this holds all relief valves open. Due to continuous escape of air on both compression and expansion

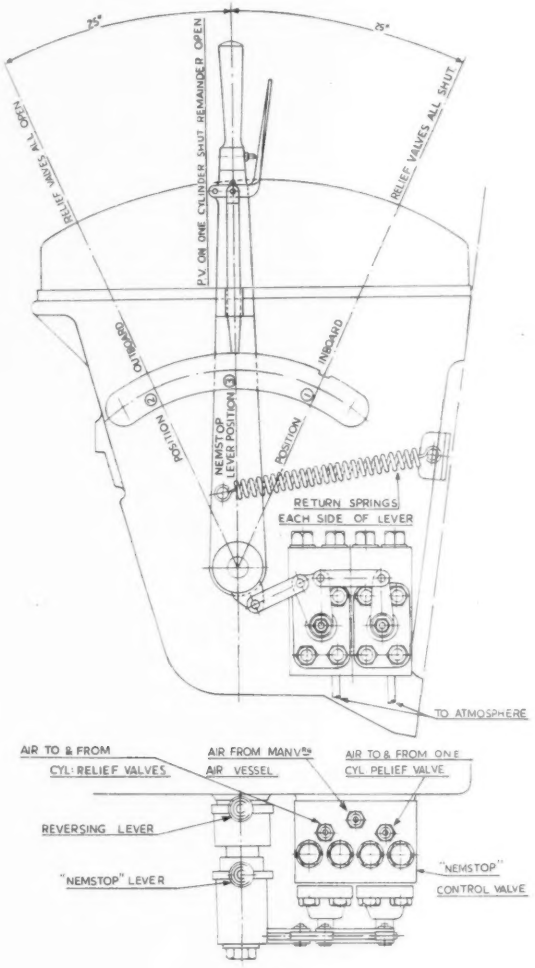


Fig 2

strokes, a net braking effect is obtained and quickly stops the engine.

Two-stage Operation

When the engine has a tendency to "crawl", the lever is placed in the central position. This restores full compression in one cylinder, the increased resistance during the compression stroke being sufficient to stop the engine.

Scavenging

After a long period of standby, Nemstop can be used to scavenge the combustion space by placing the lever in the outboard position. On applying starting air the engine will turn slowly and scavenge through the relief valves.

A further advantage of Nemstop is its ability to stop the engine quickly in the event of a defect arising in running gear or services.

The operations of Nemstop in the *British Vigilance* trials are shown in Fig 3, in which engine rev/min are plotted against time.

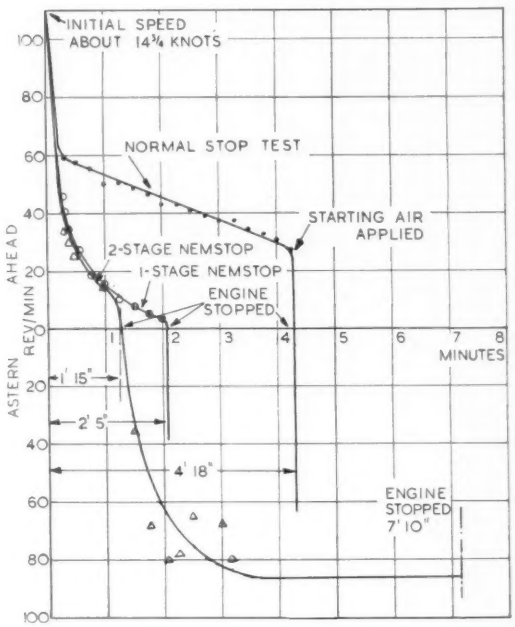


Fig 3

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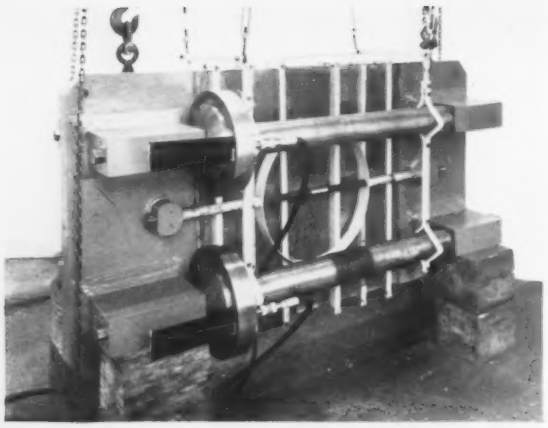
IP ECONOMICS AND OPERATIONS GROUP

The 1957 session of the IP Economics and Operations Group opened on 15 October with a very interesting talk by D. G. L. Bean (*BP Tanker Co. Ltd*) on the subject of the economics of tanker design.

For the second meeting, on 14 November at Shell-Mex House, W. S. Ault (*Shell-Mex and BP Ltd*) will speak about the relations between the oil and the automobile industries.

From 19 December meetings will normally be held in the IP new HQ at 61 New Cavendish Street, London, W.1. On that date the subject of oil prices in 1957 will be dealt with by E. A. Higgins (*The Shell Petroleum Co. Ltd*). Subsequent meetings will discuss such matters as: Energy studies (Dr R. Regul, *European Coal and Steel Community*), 9 January; The fuel economics of public road transport (A. T. Wilford, *London Transport Executive*), 13 February; Development of nuclear power, (J. A. Jukes, *U.K. Atomic Energy Authority*), 13 March; 1957 and its implications for the oil industry (J. Senior, *Esso Petroleum Co. Ltd*), 10 April.



The 700-ton per square inch rig for brittle fracture research.

Welding and Oil Industry Equipment

The Importance of the BWRA Work

At the recent Summer Meeting of the IP, Dr H. Harris, chief metallurgist of Babcock & Wilcox Ltd, opened his paper on "Metallurgy" as follows: "The subject of welding is readily acknowledged to be of supreme importance in the oil industry". In the paper frequent reference was made to the British Welding Research Association and to the importance of investigations being carried out in its laboratories.

It appeared without doubt that an account of some of the work of the BWRA could be of considerable interest to IP members and a visit was made to the BWRA laboratories for this purpose. The result of that visit is this necessarily brief account of some of the activities upon which the research staff are engaged under the guidance of the director of research, Dr Richard Weck, the deputy director, H. F. Tremlett, and the assistant director, Dr A. A. Wells.

The Association

The idea of a welding research organization originated during a welding symposium held by the Iron and Steel Institute in 1935. As a result, the Welding Research Council was set up as part of the Institute of Welding. It had no laboratories of its own and its researches were either carried out in the works of industrial companies or by sponsored investigations in the universities. For example, some work on high alloy steels was done in Birmingham University, while at Cambridge investigations were carried out on the plastic theory and on the fatigue resistance of welded structures.

By 1946 the need for expansion of the work of the Council and for centralization had become very apparent. The Department of Scientific and Industrial Research agreed to support the work and the BWRA was formed and set up its present research station at Abington Hall, near Cambridge.

Unlike most research organizations, which serve one industry and one industry alone, the BWRA serves in effect every industry. Without welding many advances in technology would not have been possible and much of the plant and equipment used in the petroleum industry could never have been developed. It is rightly claimed that the facilities available at Abington are unique in the world.

The Association derives its income mainly from the voluntary subscriptions of its members, associate members, and contributors, plus a percentage grant made by the Government through the DSIR. It also carries out a certain amount of contract work on behalf of members. Its membership is spread throughout all industry, one advantage of this being that experience gained in solving one industry's problems can often be applied to the problems of another.

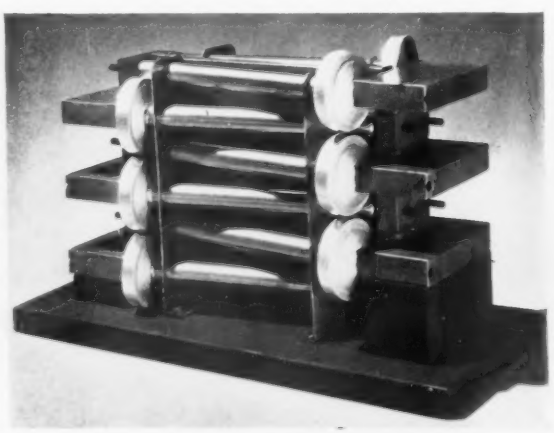
Welding Research

It is probably true to say that practically all the research work of the BWRA has some impact on the petroleum industry. However, in the short time and space available it is only possible to touch upon those aspects which appear to be the more important.

Brittle Fracture

One problem in which the oil industry has a major interest is that of "brittle fracture", *i.e.* the rapid rupturing of steel at low static stress levels. This problem is one which affects such equipment as storage tanks, pipelines, tankers, etc. Its solution would do much towards relieving the petroleum industry of the ever-increasing problem of shortage of steel.

A model of the 2000-ton brittle fracture rig for 3-inch plates.



The petroleum industry perhaps has an advantage in that the loading conditions of most of its structures are closely known. For example, the weight of oil to be contained in a storage tank varies only with the depth of oil in the tank and, therefore, the stress factors are known.

The present API specifications for storage tanks are based upon low design stresses. If the solution of the brittle fracture problem makes it possible to use thinner plates with higher stress factors, then a saving of perhaps up to 20 per cent in steel requirement can be made. The importance of this needs no emphasis.

The main investigation in the Brittle Fracture Laboratory at Abington is directed to the determination of the conditions under which brittle cracks are generated in welded structures and the benefits to be derived from stress-relieving treatments.

The main rig used in this work is designed to break a 1-inch plate 48 inches in length and 36 inches wide. The plate is butt welded in the direction of the stress and a sharp notch is made in and extends a short distance into the parent metal. The total load is 700 tons psi applied by four oil hydraulic capsules working up to 500 psi. Maximum stroke of each capsule is 0·4 inch and the specimen can be cooled to as low as -60° C by frozen CO_2 packed in transparent boxes. Repeated loads can be applied by the use of a pulsating pressure valve.

This research on brittle fracture is to be extended to plates of 3-inches thickness. A new testing rig, operating on the same principle as the 700-ton rig, but capable of applying a load of 2000 tons is under construction. This load will be distributed to a 36-inch square test piece by twelve capsules.

Among the other equipment in the Brittle Fracture Laboratory is a Charpy impact test machine.

Pressure Vessels

The design and performance of branches in welded pressure vessels is at present under investigation and for this purpose a test vessel 40 inches in diameter, 9 feet in length, and having a wall thickness of $4\frac{7}{8}$ inches is used. It is fitted with two 12-inch bore and two 8-inch bore branches, one of which in each size is flush on the inside of the vessel while the other protrudes. Tests are being made to confirm that, as indicated by a method of calculating the maximum stress intensification factor developed by the BWRA, no reinforcement is needed around the branches.

Pulsating pressure fatigue tests are also carried out on a variety of model vessels each 20-inch bore and 1 inch thick with one branch $6\frac{7}{8}$-inch bore and $\frac{3}{8}$ inch thick. Pressure is continuously variable between 0 and 6000 psi at speeds of up to 100 cycles/minute. Various tests are being made to obtain a range of fatigue lives from 1000 to 2 million cycles.

Much of the work dealt with in this section is also applicable to branch connexions to main pipelines.

The analytical laboratory is fully equipped for chemical tests and gas analysis.

Welding equipment in the Radioactive Metal Laboratory.

Welded Tank Openings

Of considerable value to the petroleum industry are the tests which have been and are still being made on openings in welded storage tanks. As a first result it has been found possible to design the manhole neck so as to eliminate the need for the reinforcing plate.

Initially, stress distribution and ultimate strength were determined on a full-size 24-inch manhole in a large plate. Further tests are being made on quarter-scale models to confirm the acceptability of the mathematical analysis on which is based the design method for manholes without reinforcing plates.

Metallurgy

In the autumn of 1956 the metallurgical laboratories and staff transferred to new premises at Abington. This building has a floor area of about 13,000 sq. ft. and comprises a welding laboratory, a heat-treatment room, a general laboratory, a machine shop, and stores facilities.

The welding laboratory contains up-to-date manual and automatic welding equipment and is divided into four main bays, in two of which the operations can be viewed through tinted glass windows from the instrument room. Metal-arc and gas-shielded welding equipment is provided and automatic traversing units are extensively used. One such unit with a speed range of 200-500 inches per minute is under construction.

Among the investigations which can be carried out in this laboratory are the study of welding arc behaviour, the automatic welding of aluminium at high amperage, the problem of hot cracking in weld metal, and so on.

The adjoining instrument room provides facilities for the observance of welding processes and the measurement of variables. Observation of operations is made through coloured windows to provide protection from the glare of arcs and fume and spatter.

The heat-treatment room has seven heat-treatment furnaces, controlled from a panel in the instrument room, and two small melting furnaces. Here also are produced special filler alloys for use in research programmes. These can be cast to a variety of requirements and a wire-drawing machine is provided for the production of welding wire.

General and Analytical Laboratories

This section, although part of the metallurgy building, contains mechanical testing equipment and other apparatus of common interest to all research groups. For example, it has prepared classified radiographs for aluminium-alloy fusion welds and can carry out small-scale hot-cracking tests.

Work on filler materials and joint strength at high temperature is also carried out in the general laboratory, as also is high temperature tensile testing at temperatures up to 1450° C.

Facilities for chemical and gas analysis are provided in the analytical laboratory, and include a polarograph for the analysis of small quantities of weld materials. A method is being developed for the identification of gases in weld metal voids and the method of determining the quantity of hydrogen trapped in a weld bead has been improved.

Fatigue Testing

In the Fatigue Laboratory a considerable amount of experimental work is carried out on fatigue strength of butt welds and various types of machine, including a 100-ton hydraulic machine, are used for this purpose. A 180-ton universal testing machine is also used in this laboratory and has been employed in testing the $\frac{1}{4}$-scale models of 24-inch manhole openings in storage tanks.

For the testing of weld joints in heat resisting materials at elevated temperatures direct loading machines, each of 2 tons capacity and with furnaced equipment, are being used. The programme now in progress concerns the purpose of welded butt joints in Nimonic 75 at temperatures up to 800° C.

Fatigue tests of plate specimens are also conducted in a 100-lever fatigue machine which can accommodate specimens $\frac{1}{2}$-inch thick and 18-inches wide. Studies are also made on fatigue problems in a variety of structures including steel shafts reclaimed by welding, thin gauge box sections, thick wall pipe, fusion welded joints in aluminium alloys, steel frames for buildings, etc.

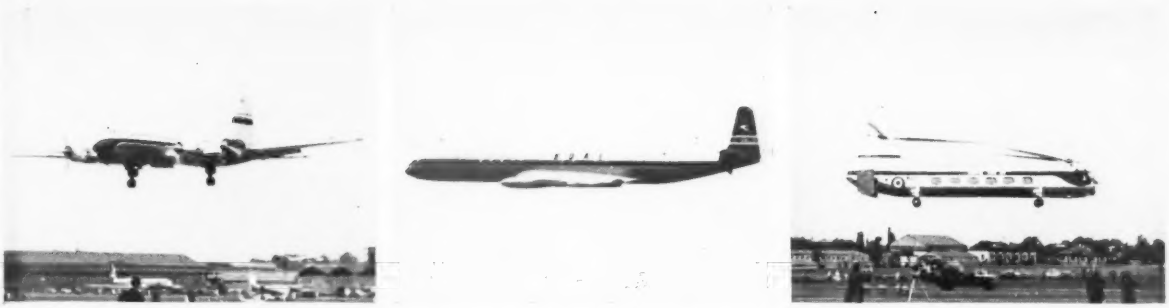
Laboratory equipment includes a Vickers projection microscope and a Reichert metallograph.

LABOUR STATISTICS FOR THE U.K. PETROLEUM REFINING INDUSTRY

The following figures are taken from the September, 1957 issue of the *Ministry of Labour Gazette* (cf. previous figures given in the *IP Review* (1957, **11**, 228)).

Figures in bold type are the averages for all the industries covered by the tables.

	Men (21 and over)	*Youths and Boys*	*Women (18 and over)*	*Girls*	*All Workers*
No. of wage-earners covered by remuneration statistics	19,234	710	1198	25	21,167
Average earnings in second pay-week in April, 1957 (shillings)	252/9 **241/6**	112/11 **105/–**	131/4 **125/10**	— **83/11**	241/– **204/7**
Average number of hours worked in this pay-week ...	48·5 **48·5**	44·8 **44·9**	43·0 **41·5**	— **42·4**	48·1 **46·6**
Average hourly earnings in this pay-week (pence) ...	62·5 **59·8**	30·2 **28·1**	36·7 **36·4**	— **23·8**	60·1 **52·7**
			Males	*Females*	
Numbers employed (July, 1957)			33,500	7,200	40,700
Numbers unemployed (at 11 Aug., 1957)			207	25	232



Flying at Farnborough 1957—*the* Britannia *with an engine test bed with Bristol turbo propeller engines; the De Havilland* Comet 3 *development aircraft for* Comet 4 *and* 4B *airliners with four Rolls Royce Avon turbo jets; the Bristol type* 173 10/13 *seat helicopter with two Alvis Leonides engines; and—*

FARNBOROUGH 1957

The Shape of Things to Come

Once again Britain's power in the air was on show on the occasion of the recent 18th Flying Display and Exhibition, organized by the Society of British Aircraft Constructors and the tenth successive annual show. Over 50 aircraft were on exhibition together with the products of over 300 members of the Society. A part of the exhibition was also devoted to a special display of guided weapons, which perhaps might be termed "the shape of things to come".

The flying display, always a spectacle, but this year limited by the ban on supersonic flying imposed by the Ministry of Supply, followed the usual trend with various types of civil and military machines showing their paces. The machines seen in the air included the Bristol *Britannia*, the De Havilland *Comet* 3, the English Electric *Canberra*, the Folland *Gnat*, the Hanley Page *Victor*, the Saunders-Roe *S-R.*53, and so on.

In the display of guided weapons there were a variety of surface-to-air and air-to-air guided weapons and these included the English Electric *Thunderbird*, the Fairey *Fireflash*, the Bristol *Bloodhound*, and a variety of other designs.

The Indoor Exhibition

Although the mass of equipment included in the indoor exhibition had little to do with the petroleum industry as such, it was noted that many Member-Companies of the IP, who are also suppliers of equipment to the aircraft industry, were represented.

The petroleum industry itself was only sparsely in evidence, the only companies noted being British Petroleum Co. Ltd, Esso Petroleum Co. Ltd, Manchester Oil Refinery (Sales) Ltd, and Shell-Mex and B.P. Ltd.

The Esso Petroleum Company's stand was mainly devoted to a model of the proposals which the Company had made in connexion with the re-organization of the fuelling of aircraft at London Airport. The tendency for refuelling trucks to become larger and heavier and thus to require more space on the aprons means increased costs. The proposals put forward by Esso Petroleum provide refuelling docks in selected areas to which aircraft would be towed or taxied for their fuel tanks to be filled.

Underwing refuelling would be carried out by four booms which would swing out under each wing of the aircraft and withdraw parallel to the sides of the dock when refuelling is complete. For overwing refuelling a cantilever roof projecting from the main construction would carry the necessary hoses and these would be retracted when refuelling was complete.

the Conway Vulcan *with four Rolls Royce Conway turbo jets; the English Electric* Canberra Mark 8 *with two Rolls Royce Avon turbo jets; and the Handley Page* Victor B Mark 1 *with four Armstrong Siddeley Sapphire engines.*

The dock would be equipped with fire fighting equipment and a weigh-bridge system and would have sufficient underground storage for all grades of products.

The joint stand of the B.P. Aviation Service and Shell-Mex and B.P. Ltd carried a panoramic model demonstrating the stacking of airliners at different heights while awaiting their turn to land at London Airport. This model was 9 ft long, 7 ft deep, and 7 ft high, and it illustrated how aircraft are stacked at 1000 ft intervals in the areas north and south of the airport while they are waiting to be called in to land.

Exhibits of other member companies of the IP included the following:

The English Electric Co. Ltd—This Company was well represented in the indoor exhibition with examples of its guided weapons systems, and in the outdoor exhibition with *Thunderbird*, the surface-to-air guided weapon now in production. In the flying display the P1A and the P1B both took part, the latter travelling at as close to the speed of sound as was permissible. The Company's *Canberra* machine was also flying and in the Static Exhibition the P1B was on show during the non-flying period.

British Insulated Callender's Cables Ltd—This exhibit covered low weight and oil-resistant cables for general service wiring, together with various types of cables and winding wires, including the new PTFE and silicone high-temperature types.

The Decca Navigator Co. Ltd—This Company was exhibiting its new Mark 10 receiver and Decca components, together with the Flight Log computers, and other airborne equipment.

Imperial Chemical Industries Ltd—The Metals Division was exhibiting various aluminium, copper, and other alloys together with wrought zirconium niobium, and other new metals. The Paints Division provided a comprehensive range of metal pre-treatment processes and paint systems and the Plastics Division covered a wide range of plastic materials for the aircraft industry.

Manchester Oil Refinery (Sales) Ltd—In addition to demonstrating its M.O.R. flaw detection fluids for the non-destructive testing of aircraft components, this exhibit also showed oil products, including hydraulic oils and a range of mechanical seals for rotary shafts.

The Mond Nickel Co. Ltd—Publications regarding nickel alloy steels, etc, were available on this stand.

The Pyrene Co. Ltd—The Company's exhibit included fire extinguishing equipment for aircraft and airfields, smoke and fire detecting systems and, in the outside equipment exhibition, an aircraft crash tender of the latest type with a foam output of 5000 g.p.m.

Rubery Owen & Co. Ltd—Various aircraft sundries were shown including bolts, nuts, special turned parts, valve gear, etc.

Serck Radiators Ltd—Engine and hydraulic oil coolers, air and oil-heated fuel heaters, de-icing heat exchangers, and sheet metal fabrications were on view on this Company's stand.

Zwicky Ltd—This Company exhibited floating suction headers for bulk storage tanks, ring mains pressure controllers, filters, refuelling nozzles, and hand pumps. In the outside equipment exhibition, a runway sweeper was on show together with an aircraft refuelling tender and a servicing trolley.

"The shape of things to come", the English Electric Thunderbird, *a surface-to-air guided weapon system now in production. This has an internal sustenance motor and four wrap-round boosters, and is available in both static and mobile versions.*

The Static Aircraft Exhibition

The Static Air Park offered an opportunity for close inspection of some of the latest products of British Aircraft, some of which were taking part in the flying display. An old friend was the huge Bristol *Beverley* which, it was pointed out, had been used for the transport of drilling equipment between Iraq and Qatar. The machines on show included a *Britannia*, a *Vampire*, a *Comet*, the *Gannet*, *Firefly*, the *Hunter F.6*, the Hunting Percival *President*, the Scottish Aviation *Prestwick Pioneer*, the Vickers-Armstrongs *Viscount* and *Valiant*, to mention but a few.

The Pipeline Industries Guild

The first meeting of the current session of the Pipeline Industries Guild was held at Caxton Hall on 8 October when H. R. Lupton, O.B.E., M.C., delivered a paper on Pipes as Water Mains. The chair was taken by J. W. Jones, chairman of the Guild, and an interesting discussion followed.

The next meeting of the Guild will be held at Caxton Hall on 12 November when G. A. K. Stobie and J. J. Maye will talk on the subject of Pipeline Welding Inspection. The meetings are open to anyone interested in pipelines and details of the Guild may be obtained from the Secretary, at 7 Iddesleigh House, Westminster, S.W.1.

ALUMINIUM-ALLOY STORAGE TANKS

A new tentative standard of the API (STD 12G) is a specification for welded aluminium-alloy storage tanks. It covers above-ground atmospheric pressure, vertical, cylindrical, closed and open top tanks, including shells, bottoms, structural-supported and self-supporting roofs, and ladders, walk-ways, etc.

Details are given of material, design, fabrication, erection, testing of shell joints, and welding procedure. Appendixes cover design data, foundation construction, and filler metal for welding.

Price of this 67-page standard is $81·00. It is obtainable from API, Division of Production, Dallas 1, Texas, U.S.A.

The Future of the Petroleum Industry in India

If the proposed rate of India's industrial growth is maintained, the country's annual requirements of crude oil will amount to more than 50 million tons by the end of the fifth Five Year Plan in 1976, involving foreign exchange expenditure of the order of Rs 500 crores (£375 million) per annum unless self-sufficiency in oil is attained first.

This estimate was given by Sri W. B. Metre in his Presidential Address at the 33rd Annual General Meeting of the Geological, Mining and Metallurgical Society of India held in Calcutta on 21 September.

Sri K. D. Malaviya, Minister for Mines, Fuel and Power, was the chief guest at the function, and in welcoming him the President said that his presence provided encouragement to the speaker to "take a look at the challenging future that faces the petroleum industry in its efforts to contribute substantially to India's economic progress."

In a comprehensive review of India's petroleum supply and demand prospects Sri Metre gave "realistic estimates" of the country's oil needs for the next 10, 15, and 20 years, and urged Indian industrialists to participate in the task of achieving self-sufficiency in oil for the nation.

The annual rate of increase in the consumption of petroleum products will rise steadily from the present 10 per cent to 14 per cent by 1967, when it will remain at that level until 1976, Sri Metre said. Even with these small increases the total requirements of crude would amount to 78 lakh tons in 1961, 140 lakh tons in 1966, 270 lakh tons in 1971, and 520 lakh tons in 1976, and if there were any delays in achieving the future production targets for coal these figures would be increased.

The Nation's Security

"It seems highly improbable that the country could afford to import such large volumes of oil, which would involve foreign exchange of the order of Rs 500 crores (£375 million) a year," Sri Metre continued. "Moreover, dependence on large imports of crude will adversely affect our national security. We must therefore find enough oil and gas in the country to meet the major part of our demand for petroleum fuels unless we are prepared to slow down the proposed rate of industrial progress."

No-one could say categorically whether such large quantities of oil, requiring underground reserves of 800 million tons, would be found in the country, but from experience elsewhere in the world it was likely that the task would only partly be accomplished within 20 years.

"It follows that the maximum effort is called for, employing with the utmost urgency every device and agency available. My personal view is that, in order to reach the targets envisaged it will be necessary to interest at least a dozen oil companies possessing the necessary large resources and know-how."

Given the resources and the determination to face the challenge, self-sufficiency was a possibility since there were in India large sedimentary areas, of which only a very small part had so far been investigated by modern geological and geophysical surveys and the technique for finding oil was making great strides.

Thousands of Wells Needed

The President said that the exploratory effort required to achieve self-sufficiency should be directed towards discovering additional crude oil production of 4·5 million tons by 1961, 11 million tons by 1966, 25 million tons by 1971, and 50 million tons by 1976. A part of the work was already in hand but it was only a very insignificant fraction of the total effort needed. Many thousands of wells, of a depth considerably greater than the average in U.S.A., would have to be drilled, and the total expenditure of drilling and production was estimated to be about Rs 1500 crores (£1125 million).

To this sum would have to be added the cost of refining, transportation, distribution, and marketing estimated at another Rs 1500 crores, so that the total investment by 1976 to ensure self-sufficiency in both crude oil and refined products would be of the order of Rs 3000 crores (£2250 million), or Rs 600 (£45) per ton of new production.

"Half of this investment will be required by 1971 at the rate of Rs 80 crores (£6 million) a year until 1966, rising to Rs 170 crores (£127·5 million) a year during the fourth Five Year Plan, and to Rs 300 crores (£225 million) a year during the fifth Plan (1971–76)."

The expenditure on drilling and production alone, the speaker pointed out, would be much less than the cost of importing the crude oil.

Sri Metre observed that, despite the progress made by the Government's Oil and Natural Gas Commission and the exceptionally good drilling speeds achieved by the oil companies in the restricted areas allotted to them, the present rate of progress was "very inadequate" for attaining the goal in view.

Vast Areas to be Surveyed

"There are vast areas which await detailed geological and geophysical investigations and exploration by drilling," he declared. "The size and urgency of the task is such that it seems impracticable for the Oil and Natural Gas Commission and the public purse to undertake more than a part of it. The Government should throw open the remaining areas to those who are prepared to risk their money and explore for oil under such methods of Government control as will help and encourage investment."

If Indian capital proved unwilling or unable to take a share of the responsibility, the Government should encourage foreign oil companies to carry out the work. Controls against "monopolistic exploitation or any of the other bogies we hear so much about" could easily be devised in forms acceptable to the companies, but as the latter had the necessary knowledge, experience, and funds they could not be expected to relinquish control of these resources to others much less experienced in such enterprises. Rather than do

this, they would prefer to employ their resources elsewhere where such conditions did not exist.

"I am confident that the oil companies fully appreciate India's point of view as stated in the minerals policy resolution of 30 April 1956, and that with correct approach and good will on both sides methods of reconciling the companies' point of view with that resolution can and should be found."

Summing up, the President said that the task of attaining self-sufficiency in oil in the face of growing demand was a question of "all hands to the pump." "If there is a way," he concluded, "I am sure our Chief Guest will find it."

Oil Progress in 1956–57

Earlier in his address the President reviewed the progress to date of oil exploration in West Bengal, Punjab, and Assam. Ten more wells had been drilled in the Nahorkatiya-Hugrijan area of the Assam Valley during the past 12 months but the results failed to make any material addition to the reserves (2½ million tons a year) already proved in that area.

In Moran four wells had so far been completed, the first two being successful but the third and fourth proving unsuccessful. A fifth well was spudded-in at Moran in the early part of September and the programme for the next 12 months visualized intensification of the drilling effort.

In the old Digboi field it might soon be necessary to curtail production to about 250,000 tons a year in order to prevent a more rapid decline later and to ensure maximum ultimate recovery. Refining at Digboi has been increased to the maximum capacity of the plant, thus enabling a reduction in the volume of oil products imported to meet the country's needs.

Further discoveries in the Assam Valley might make possible a substantial increase in the present production target of 2½ million tons a year. The possibility of this depended firstly on the degree of success which can be maintained in the Nahorkatiya-Hugrijan and Moran areas (which might increase the target before very long to about three million tons a year) and secondly—and more important—on the degree of effort which can be put speedily into further exploration in the other areas of Assam which still call for further geophysical reconnaissance. This will entail much additional finance.

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NEW NATURAL GAS PIPELINE NOW OPERATING IN VENEZUELA

A new 20-inch diameter pipeline is carrying natural gas from the La Paz oilfield, in the Maracaibo district of the state of Zulia, to the Cardon oil refinery on the Paraguana peninsula, Venezuela. Costing £9 million and built in 12 months, the line is 180 miles long and has a nominal capacity of 100 million cubic feet per day.

Cia. Shell de Venezuela has already started pumping high-pressure gas through this facility and it will be used in place of liquid fuel in running the refinery. Within a few months, gas will be burned exclusively in all furnaces. This development will facilitate the economic use of the natural gas which is produced with the crude and will also release additional heavy fuel oil for export markets.

"FINA NEWS" IN A NEW STYLE

Fina News, house organ of Fina Petroleum Products Ltd, is now appearing in a new form and the first issue in this style announces two new publications—*Fina Staff News* and *Fina Dealer News*. The Summer 1957 issue includes, as a main feature, a supplement giving extracts from the 1956 Annual Report of the Petrofina Group, this being introduced by C. M. Merrick, the managing director of Fina Petroleum Products Ltd.

Features in this issue include an illustrated account of the construction of a filling station, an article on the use of petroleum products in agriculture, and pictures of some of the Stately Homes of Lakeland heated by the use of fuel oil.

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Aden Refinery

A general view of The British Petroleum Company's refinery at Aden. Its annual capacity is five million tons of crude oil.

New Books

Shell Technical Publications

A useful catalogue of technical papers, prepared by N. V. de Bataafsche Petroleum Mij and by The Shell Petroleum Co. Ltd and published during 1956, is now available. There are 97 entries in the BPM list and 30 entries in the Shell list, all of which are classified by subjects and indexed by authors' names.

Copies of the catalogue and a post card for ordering reprints of the papers listed may be obtained from The Shell Petroleum Co. Ltd, Public Relations Dept., St. Helen's Court, Great St. Helens, London, E.C.3.

The Industry's Handbook

Once again and for the 48th year Walter E. Skinner has produced what is without doubt one of the most valuable books in the petroleum industry. It is the "Oil and Petroleum Year Book," the 1957 edition of which has just come to hand. In it are details, complete and up to date, of over 1000 of the principal oil companies operating in all parts of the world and covering British, American, Canadian, and other companies. In each case information is given regarding directorate, operations, capital, dividends and accounts where such information is available.

There is also in this issue a new feature in that three two-colour maps are included. One covers the Canadian oil and gas fields and pipelines, the second the Trans-Canadian natural gas transmission system, and the third, Middle East oilfields, refineries, pumping stations, and pipelines. On the reverse of the latter there is also a diagram showing Western movements of Middle East oil for the past 36 years.

Other features of the book are a buyer's guide section in which manufacturers of plant equipment and accessories are listed under about 1000 headings and a list of 720 names and addresses of managers, engineers, and agents of other companies.

Priced at 32s post free copies can be obtained from Walter E. Skinner, 20 Copthall Avenue, London, E.C.2.

Canadian Mission Report

The report of the Mission to Canada, to which reference was made in our September issue, has now been published by The Council of British Manufacturers of Petroleum Equipment. It is entitled "Report of the Economical, Technical and Goodwill Mission to Canada" and is priced at 12s. 6d. Its 47 pages are a mass of useful information to suppliers of petroleum and similar equipment who wish to enter the Canadian market. Its various sections, in addition to useful general information, cover purchasing methods, selling pointers, and reports on individual types of equipment. There is also a very valuable list of the companies visited during the Mission and, most important, of the people in those companies who were interviewed. Details are given regarding the oilfields in Canada and two useful maps of oilfields and refinery locations are included.

One of the conclusions of the Mission is that as far as can be determined British industry is believed to be capable of satisfying the entire requirements of the Canadian market for refinery, process, and production equipment. A portion of the market for oil well drilling equipment could also be satisfied by British industry. Various recommendations for a prospective entrant into the Canadian market are given.

A *Financial Times* Survey of Chemicals

During August the *Financial Times* published a 48-page survey on Chemicals, to which F. E. Salt and Dr H. K. Whalley (*The Distillers Co. Ltd*) contributed a chapter on petroleum chemicals. They concluded that there was a considerable future still open to the U.K. petroleum chemical industry, quite apart from any new processes and products which might yet be disclosed by research workers.

In an article on the sales of synthetic detergents, R. C. Tarring (*Shell Chemical Co. Ltd*) mentions that the three main suppliers of detergent alkylate—Grange Chemicals, Monsanto, and Shell Chemical Co.—have between them capacity more than adequate to meet foreseeable domestic U.K. requirements. This is being used to build up useful exports of alkylate for manufacture of powders locally. For industrial use, the two main types of liquid detergent are alkyl sulphates and ethylene oxide condensates. The importance of petroleum-based materials as sources of synthetic detergents is plainly apparent.

On the subject of chemical fuels for power, Sir Alwyn Crow, C.B.E., refers particularly to propellants for military rockets. With liquid fuel systems, most of which work on the principle of using an oxidant in conjunction with a fuel such as alcohol or petrol, the efficiency is higher than can be reached with solid fuels. Typical fuel systems are liquid oxygen and kerosine, nitric acid with kerosine or aniline, and concentrated hydrogen peroxide with kerosine.

Gassing Casualties

In 1952 the Association of British Chemical Manufacturers issued a booklet dealing with the labelling of persons who had been exposed to noxious gases and who were being sent to hospital for treatment. The object of these labels was to indicate to the medical officer the type of gas to which the patient had been exposed, to show what treatment had already been given, and to indicate possible subsequent treatment.

This system of labelling evinced considerable interest in hospitals and medical organizations and with many chemical firms. The labels have now been revised and the second edition of this booklet is now available at a price of 5s. post free from the ABCM, Cecil Chambers, 86 Strand, London, W.C.2. Cash with order is requested. Altogether 47 individual gases are dealt with in a series of 20 labels, the alphabetical list commencing with acetic anhydride and finishing with xylene; including petroleum fumes. Pads of labels for the various gases are also available and can be obtained from the Association price 2s. 6d. each.

* * *

MIDDLE EAST PRODUCTION

Tons

	Aug.	*Jan.–Aug.*
Iraq Petroleum Co. Ltd ...	1,249,991	6,054,036
Basrah Petroleum Co. Ltd ...	684,826	5,531,402
Mosul Petroleum Co. Ltd ...	61,470	272,153
Qatar Petroleum Co. Ltd ...	582,028	4,126,362
Iraanse Aardolie Exploratie en Productie Mij	3,150,000	22,743,000

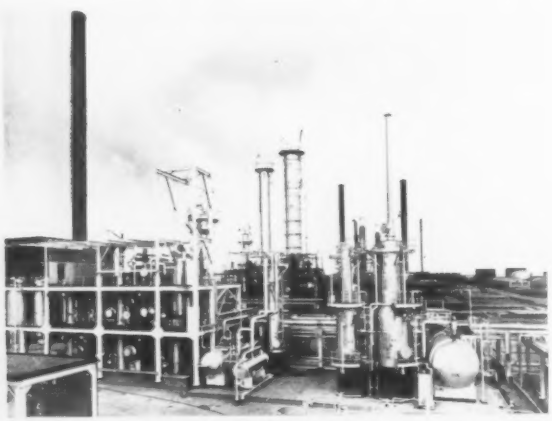
The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for August was 1,264,000 tons, the total for 1957 being 10,454,000 tons.

The Synthetic Detergent Industry

A general view of the detergent alkylate plant at Shell Haven (l. to r.) *scrubber section, distillation unit, heater, and stack.*

The growth of the synthetic detergent industry has been one of the outstanding events since the second world war, although in fact the history of synthetic detergents goes back to the first world war, to products developed in Germany from coal tar base materials. During the 1930's synthetic detergent powders were placed on the household market in Germany and the U.S.A. but they were more expensive and not appreciably more efficient than soap powders. The alkyl aryl sulphonate type of detergent appeared in Germany during the second world war when keryl benzene alkylate was produced and sulphonated for liquid and powder products; keryl benzene, however, does not give good powders and its manufacture has been largely discontinued.

Nearly all synthetic detergent powders to-day, and in the U.S.A. they represent about 50 per cent of the total soap/detergent usage, are based on dodecyl benzene sulphonates prepared from propylene tetramer alkylate. Not only was manufacturing capacity (from wartime aviation gasoline alkylation units) available in the U.S.A. after the war but the raw materials, benzene and tetrapropylene, were in comparatively free supply.



Scrubber section and acid catalyst unit, with distillation unit in background.

The introduction of sulphonate-based powders in selected hard water areas was followed by an unexpected nation-wide demand so that such powders, with little technical advance in the past ten years, have continued to gain against soap powders to the extent noted above. Similar developments have taken place in countries other than the U.S.A.

The petroleum chemical industry was closely concerned with developments from the very start, in fact the Shell Group were the first petroleumchemical suppliers of a synthetic detergent with their secondary alkyl sulphate, Teepol, (first sold in 1942); they were also the first manufacturers of propylene tetramer detergent alkylate outside the U.S.A. from a plant at Curaçao which came on stream in 1948. As a result the Group has been one of the main suppliers of synthetic detergent raw materials in the world during the last few years; they now have three Teepol plants in England, Holland and France, and manufacturing capacity for non-ionic detergents also in England at the recently acquired works of Petrochemicals Ltd.

Shell Haven Detergent Alkylate Plant

It had become obvious that the alkylate plant at Curaçao could not keep pace with the increasing demand for Shell's detergent alkylate (DOB-PT) and the decision was therefore taken to construct a large modern plant at Shell Haven, near London. Development work was carried out on a pilot plant in the Netherlands by the B.P.M. The new plant, which has an annual capacity of 30,000 tons of high quality detergent alkylate, came on stream in July 1956: about half of the alkylate is exported.

Layout of the Plant

The plant was built for Shell Chemical Co. Ltd by Foster Wheeler Ltd from designs based on Shell's experience with the Curaçao plant and the pilot plant in the Netherlands. It occupies a total surface area of about eight acres and the layout follows logically from the sequence of the process steps.

The tank farm, the pump house, the reaction and distillation sections are placed in rectangular plots parallel to each other. The central control room, offices for supervising staff, and a small laboratory are adjacent to the reaction and distillation sections.

The reaction involved is a modification of the well-known

Friedel-Craft, an aromatic hydrocarbon (benzene) being alkylated with an olefin (tetrapropylene) in the presence of an acid catalyst. The product is largely mono-alkyl benzene although some di-alkylation does occur.

In the reaction section benzene and the olefin stream are fed through the feed drier, and circulated with the catalyst through the reactor vessel, which is baffled for effective mixing. Careful control of the conditions such as residence time, benzene:olefin ratio and the amount of catalyst is maintained. The reaction is exothermic and cooling facilities are included.

Most of the catalyst is separated by gravity from the crude alkyl benzene in a settler, and recycled. Residual catalyst and some excess benzene are removed by passing the product through a stripper and chemical treaters. The hydrocarbon mixture is then passed to the distillation section of the plant for further purification.

The distillation section consists of three columns. In the first column the remaining benzene is stripped off and recycled, in the second an unwanted low-boiling fraction is removed overhead, and in the third pure alkyl benzene is removed overhead. The heavy residual bottoms from the final column are removed for other uses.

A small regeneration column maintains the acid catalyst in a high state of purity and a neutral tar fraction produced is used as fuel for the plant. Due to the nature of the catalyst, strict safety precautions are observed. Protective clothing is supplied to all working on the site and to visitors, and washdown facilities are available. The action of standing under one of the showers automatically starts the shower and operates an alarm signal in the control room.

The operation of the plant is fully automatic, control being effected from a central room equipped with a Honeywell-Brown console control desk. A small laboratory equipped with a Towers automatic recording IP distillation apparatus adjoins the control room.

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U.K. CONSUMPTION OF PETROLEUM PRODUCTS

Deliveries (excluding bunkers) of petroleum products for inland consumption in the United Kingdom during the period January to June 1957 were 1,099,314 tons less than those in the same period in 1956, according to figures published by the U.K. Petroleum Industry Advisory Committee.

The decrease is largely attributable to decreases of 541,757 tons in motor spirit (including motor benzole) and of 386,248 tons in the gas, diesel, and fuel oil category.

For Scotland there was little difference in the figures for the comparable periods as will be seen from the table relating to consumption in that country. The largest decrease was for motor spirit but there was a slight increase for the gas, diesel, and fuel oil range. The Scottish consumption is also included in the U.K. total.

Full details are given in the tables below:

U.K. DELIVERIES INTO INLAND CONSUMPTION OF PETROLEUM PRODUCTS*

Product	*January to June*	
	1956	1957
	tons	*tons*
Aviation fuels	850,701	817,931
Motor spirit (incl. motor benzole):		
Premier grades	1,559,225	1,290,221
Standard grades	1,505,658	1,232,905
	3,064,883	2,523,126
Industrial spirits (incl. industrial benzole)	72,495	87,837
White spirit	77,786	75,579
Kerosine:		
Burning oil	454,554	382,250
Vaporizing oil	286,860	285,946
	741,414	668,196
Derv fuel	866,427	838,157
Gas, diesel, and fuel oils:		
Gas/diesel oil	1,221,772	1,061,927
Fuel oil	3,337,507	3,180,673
Refinery consumption ...	1,092,088	1,022,519
	5,651,367	5,265,119
Lubricating oils and greases ...	434,311	398,039
Paraffin wax and scale	25,199	24,468
Propane and butane	33,378	34,620
Bitumen	468,682	432,305
Other products	353,556	375,508
	12,640,199	11,540,885

* Excluding bunkers for ships engaged in the foreign trade.

SCOTLAND: DELIVERIES INTO INLAND CONSUMPTION OF PETROLEUM PRODUCTS*

Product	*January to June*	
	1956	1957
	tons	*tons*
Aviation fuels	93,481	63,863
Motor spirit (incl. motor benzole):		
Premier grades	115,777	96,141
Standard grades	130,547	106,815
	246,324	202,956
Industrial spirits (incl. industrial benzole)	9,280	18,177
White spirit	5,886	5,431
Kerosine:		
Burning oil	30,904	27,917
Vaporizing oil	35,896	33,438
	66,800	61,355
Derv fuel	99,458	98,082
Gas, diesel, and fuel oils:		
Gas/diesel oil	123,194	119,992
Fuel oil	222,965	235,585
Refinery consumption ...	91,915	102,813
	438,074	458,390
Lubricating oils and greases ...	36,382	35,685
Paraffin wax and scale	1,500	739
Petroleum gases	2,212	2,283
Bitumen	78,781	77,892
Other products	50,539	105,213
	1,128,717	1,130,066

* Excluding bunkers for ships engaged in the foreign trade.

Trinidad Oil in 1955

In his report* for the year 1955, W. N. Foster, the Petroleum Technologist for Trinidad and Tobago, states that the total production of 24·9 million barrels of crude petroleum was 5·4 per cent higher than the 1954 total of 23·6 million barrels. The quantity produced by natural flow was 58·1 per cent of the total, compared with 48·3 per cent in 1952, although the number of pumping wells increased by 10 per cent in the same period.

Statistical details extracted from the report are given in the accompanying table.

The total number of wells completed during the year was 215, of which 191 were oil wells. Total footage drilled was 987,567, an average of 4372 ft per completed well. The Antilles Company started drilling on their marine licence, but the well was finally abandoned for technical reasons. The same Company drilled a wildcat on the east side of the Oropouche Lagoon and this was abandoned as all sands were water-bearing.

In the Chatham area, Apex started an exploratory well with an objective of 15,000 ft and Dominion Oil completed three wells, two of which encountered gas sands at Mahaica.

Two exploratory wells, both abandoned as dry holes, were drilled respectively at Agatha Acham, by Trinidad Central, and at Esmeralda by Trinidad Petroleum Development.

Soldado 1, the first high seas well of Trinidad Northern Areas, was completed as a commercial producer about 7 miles north of Cedros Point.

Asphalt

A total of 136,729 tons of natural asphalt was extracted from the Pitch Lake, compared with 142,101 tons in 1954.

* Trinidad and Tobago. Petroleum Department. Annual Administration Report for the Year 1955. Pp. 34 and 1 map. 1957.

Finance

Total disbursements of the oil industry in Trinidad amounted to $96·9 million, an increase of 11·6 per cent over 1954. It was made up as follows:

	$
Contributions to Government revenue ...	30,653,386
Payments to employees	34,557,926
Payment to contractors	10,643,977
Local purchases of materials	7,217,873
Rents, private royalties, etc.	13,819,910
	$96,893,072

The $30·6 million contributed to Government revenue represented 34·1 per cent of the full total of the colony and Government operated services.

In addition to local expenditure, the industry also purchased $31·3 million of supplies from overseas, of which $24·8 million was from the United Kingdom.

TRINIDAD OIL STATISTICS 1955

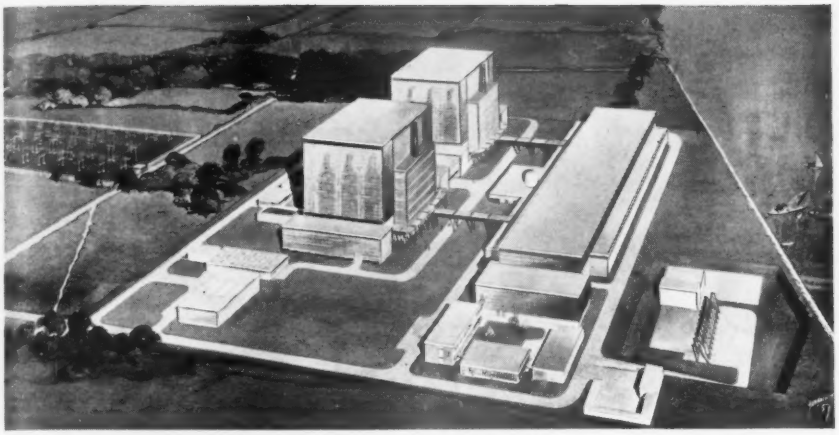
	Barrels
CRUDE OIL	
Production from Crown oil rights	19,936,814
Production from private oil rights	4,958,991
	24,895,805
Natural gasoline production:	
From Crown oil rights	181,862
From private oil rights	91,754
Total	25,169,421
Crude oil production by:	
Flowing	14,471,845
Gas/air lift	1,271,084
Pumping	7,795,386
Plunger lift	1,345,355
Other methods	12,135
	24,895,805
Daily average per well	24·8
	Thousand cu. ft.
NATURAL GAS	
Production	40,860,323
Replaced in formation	5,442,069
Used as fuel	16,825,669
Converted to C.H.P.S.	287,297
Vented as surplus	9,648,469
Sales to other industries	764,473
Pipeline losses, etc.	1,887,322
Not collected	6,005,024
	Barrels
REFINERY OPERATIONS:	
Runs to stills	40,147,088
Products:	
Aviation spirit, 100 O.N.	381,758
Aviation spirit, other	1,524,591
Motor spirit	7,701,611
White spirit	1,280
Burning oil	860,176
Vaporizing oil	2,130,349
Gas and diesel oil	7,470,198
Fuel oil	17,471,225
Lubricants	2,353
Bitumen	422,506
Other products	540,041
Liquefied petroleum gas	11,873
Feed or blending stocks	113,057
	38,631,018

COMPUTERS IN REFINERY DESIGN

It is estimated by Esso Research and Engineering Company that by using electronic computers it expects to save about a million dollars in the design and construction of a naphtha fractionation unit.

Engineer John W. Kellett said at a recent ACS machine computation symposium that the use of a computer also cut basic engineering time and manpower for the project by at least one-half. Kellett and his co-authors Edward J. Higgins and L. Tom Ung said that the use of computers in engineering work had also advanced the completion date of another large project by five months, and by three to four weeks on several smaller jobs.

The examples cited stemmed from a programme called "engineering simulation" which the company adopted to get better designs, to free engineers from routine and repetitious chores, to get jobs done quicker, and to make designs more consistent.



An artist's impression of the Hinkley Point power station.

Hinkley Point Power Station

The order for the new Hinkley Point, Somerset, nuclear power station, the largest in the world, has now been placed with the Atomic Power Projects Group of English Electric—Babcock & Wilcox—Taylor Woodrow. The first two firms are IP Member-Companies. The station is designed for a net output of 500 MW and estimated cost is £60 million. Completion is scheduled for the end of 1962 although it is expected that one of the two reactors will be in operation and producing electricity earlier in that year.

The two reactors each consist of a graphite-moderated core with a lattice of uranium fuel contained in a 67-foot diameter spherical pressure vessel of 3-inch shell thickness. This vessel will be constructed on site by welding preformed mild-steel plates.

Each fuel element consists of a rod of uranium sealed in a magnesium alloy can to prevent chemical reaction between the uranium and the coolant gas and also to contain fission products. The cans are finned to increase heat transfer and stand vertically in channels in the graphite core. They are loaded from the top of the reactor.

Carbon dioxide is the medium for conveying the heat generated in the reactor to the steam-raising units. It is circulated by means of axial-flow circulators. The hot gases leave the top of the shell via six large ducts, each of which is connected to one steam-raising unit. The six Babcock units associated with each reactor generate in total over 5·5 million pounds of steam per hour, approximately two-thirds being at high pressure. The main shells of these units are 90 ft high, 21 ft 6 in. in diameter, and have a maximum wall thickness of $2\frac{3}{8}$ in.

After passing through the steam-raising unit the gases leave by a bottom duct to the axial flow gas blower and are returned to the bottom of the reactor.

Six hydrogen-cooled turbo-alternator sets, supplied by the English Electric Co. Ltd, will be installed at Hinkley Point. Each will operate at 300 rev/min with a continuous maximum rating of 93·5 MW at a generated voltage of 13·8 kV and 0·85 power factor. There will also be three 33 MW variable-speed turbo-alternators, one being a standby set, to supply power for the gas blowers. These will be of sufficient power to allow for possible increased output from the reactors.

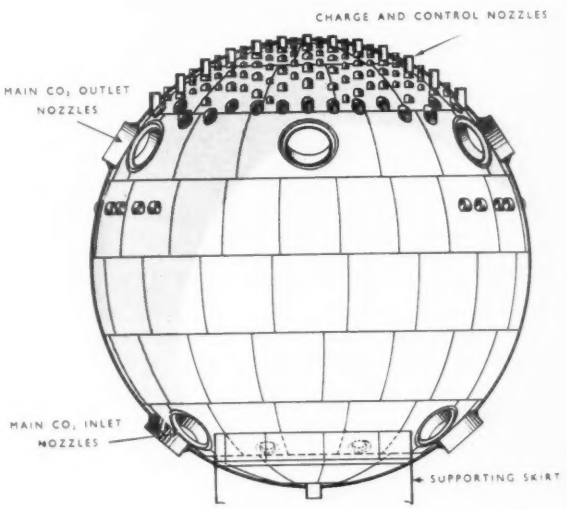
Main turbines will be of the horizontal impulse reaction design with one HP cylinder and two LP cylinders. They will operate on the mixed pressure cycle.

The turbines for the variable frequency sets will be of the horizontal two-cylinder impulse reaction type, operating at variable speeds.

Construction

A feature of the civil engineering work to be carried out by Taylor Woodrow Construction Ltd will be tunnelling under the Bristol Channel for a water-intake structure about 2200 feet offshore. A wharf will also be built at Combwich, 6 miles from the site, for the handling of bulky equipment.

The biological shields around the reactors will be of 7-foot thick reinforced concrete. Their internal diameter will be over 75 ft, their height over 90 ft from the reactor foundations, and



Section through reactor vessel.

each will be surmounted by an 11-foot thick slab of concrete. Each shield will be contained in a rectangular envelope about 140 × 100 ft.

For the whole of the station and its ancillary works, the contractors will place 300,000 cubic yards of reinforced concrete, made up of about 12,000 tons of steel reinforcement and 400,000 tons of aggregate. About 750,000 cubic yards of ground will be excavated and used to reclaim a foreshore area about 250 × 3000 ft on which some of the buildings will stand.

Prior to the announcement on 12 September of the award of the contract, site investigations, including drilling 23 boreholes, had already been made. Six miles of access road had also been completed.

The Reactor Vessel

The pressure-vessel in which the active core of each reactor is housed has been designed and will be manufactured and erected by Babcock & Wilcox Ltd. As already mentioned, it will be a sphere of 67 ft diameter made of 3-inch mild-steel boilerplate. It will be supported on a 30-foot diameter cylindrical skirt and a similar internal skirt will support the core.

The vessel will have twelve 6 ft 6 in. diameter openings for the inlet and outlet gas ducts. There will also be 170 nozzles of 3 in. to 2 ft diameter for various purposes, such as charging and discharging fuel elements, etc. Total weight of the vessel and its attachments will be about 1700 tons, and the total load carried by the external skirt will be about 5500 tons when the core and its supports are in place.

Steam-raising Units

Each reactor will have six steam-raising units (heat exchangers) associated with it. The size of the main shells of these units has been given above, and they will be mounted on skirt supports on a concrete base. Each shell will contain seven banks of flexible, multiloop, studded elements connected to horizontal external headers.

Boiler tanks will be of forced-circulation design. Steam and water mixture will pass through cyclones and scrubbers to ensure that high-purity steam reaches superheaters and turbines.

Ring-sections of these units will be fabricated and stress-relieved at the Company's Renfrew works. On site, the sections will be welded together and the welds stress-relieved by induction heating.

Fuel Handling

Equipment for handling spent and damaged fuel elements has also been designed by and will be made by Babcock & Wilcox Ltd.

A MODERN FILLING STATION

A modern BP service station recently opened in Hamburg, Germany, has six-storey parking accommodation for 700 cars. The service station has eight pumps for delivering motor spirit and diesel oil and eight washing and servicing bays. In the garage 600 cars can be parked within 30 minutes. Above top shows an outside view of the parking station and below a vehicle leaving the station.

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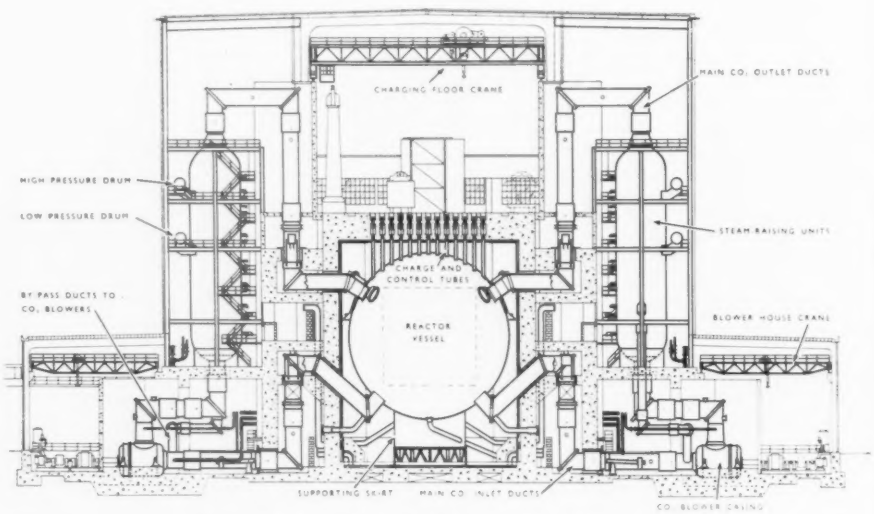

Sectional elevation through the reactor building.

CBMPE Annual Dinner

Sir **Kenneth Hague**, Principal Speaker and Guest of Honour, was unable to be present owing to indisposition and **G. H. Thorne**, Chairman of the CBMPE, addressed the large gathering of distinguished guests, members of the CBMPE and their friends. The Dinner was held at the Dorchester, London, on 26 September.

Mr Thorne referred to the highly successful Canada Mission which, sponsored by the Council and led by **J. M. Storey** (managing director, Dewrance & Co. Ltd), had made

a tour of the Canadian oil installations earlier in the year. A Report of the Mission had been published and was proving to be a 'best seller'.

He also emphasized the importance of the Chemical and Petroleum Engineering Exhibition to be held at Olympia in June 1958. There had already been an overwhelming demand for space and the exhibition would unquestionably be a very great success.

* * *

Trade Literature, etc.

New "Oilwell" Catalogue

The 1957–58 edition of "Oilwell's" 152-page catalogue is packed with details and specifications of the Company's drilling and producing machinery and equipment. Blocks, controls, derricks, drives, drilling units, pumps, rotaries, swivels, compressors, engines, gears, jacks, nipples, plugs, packers, rods, and well head equipment are only a few of the items mentioned and described.

The catalogue, which is handsomely bound in orange cloth, is obtainable from Oil Well Supply Co. Ltd, 5 Queen Street, London, E.C.4.

Drilling Holes

This is the title of the 75th anniversary catalogue of the Stardrill-Keystone Company, who produce machines that will drill holes by: (1) percussion or cable tool, (2) direct rotary, fluid or air, or both, (3) reverse circulation rotary, (4) diamond coring, (5) jetting or hollow rod, and (6) auger or earth boring.

The 154-page catalogue gives full specifications of these machines which drill holes from 1 to 60 inches in diameter. Details are also given of ancillary equipment and recommended sizes.

Copies are obtainable from the Company at Beaver Falls, Pennsylvania, U.S.A.

Pipeline Corrosion Preventive

A brochure available from the Tretolite Company, 369 Marshall Avenue, St Louis 19, Missouri, U.S.A., gives basic facts concerning Kontol 77, a corrosion inhibitor for use in pipelines, tanks, pumps, and similar product-handling equipment.

The "Utility House"

An interesting example of the use of the Leyland industrial engine is its inclusion in a portable generating set which provides up to 375 kVA. Auto Diesels Ltd, of Uxbridge, claim to be the first manufacturers in the U.K. to build these sets, known as "Unitised Utility Houses."

Sectional Drive Groups

A new series of sectional drive groups for consolidated drilling rigs is described and illustrated in The National Supply Company's Bulletin 472. In particular, features and specifications are included of the Type B-1$\frac{3}{4}$ quad. series drive group which was designed more specifically for engines rated above 525 h.p., using hydro-dynamic drives, and mud pumps at 1000 h.p. input.

Copies of the Bulletin are available on application to the Company at Two Gateway Center, Pittsburgh, Pa.

Increasing Use of "dag" Products

Several interesting examples of lubrication problems which are claimed to have been solved by the use of "dag" products are cited in the August issue of *Prospects*.

Copies are obtainable from The Editor, *Prospects*, Acheson Colloids Ltd, 18 Pall Mall, London, S.W.1.

Failing Portable Drilling Outfit

Manufactured by Mitchell Engineering Ltd of Peterborough and marketed in the U.K. exclusively by Failing Supply Ltd, the new FM3 portable drill is identical to the CFD-1 machine manufactured by the George E. Failing Company of Oklahoma. It is designed for fast shot-hole drilling up to diameters of 5$\frac{3}{4}$-inch and 1000-ft depth, using 2$\frac{3}{8}$-inch drill pipe. The mast is of welded tubular steel 31 ft 6 inches in height and is provided with crown block and raising cylinder. The double-drum draw works have a total capacity for 400 feet of $\frac{1}{2}$-inch line and the clutches for both drums are operated by a single lever. Full details are obtainable from Failing Supply Ltd, 1 Bedford Square, London W.C.1.

Weatherproof Circular Flameproof Junction Box

The General Electric Co. Ltd has extended its range of circular flameproof junction boxes to include a weatherproof type for use in unprotected and exposed situations. Designed in cast iron to BS 229—1957, it has a machined spigot joint and weatherproof seal in planes at right angles to one another. Further details are available from G.E.C., Magnet House, Kingsway, London, W.C.2.

Costain-John Brown Ltd

The name of Costain-John Brown Limited, a wholly-owned subsidiary of John Brown & Company Limited, was changed to Constructors John Brown Limited after 30 September 1957.

Holmes Catco Service

Publication No. 70 just issued by W. C. Holmes & Co. Ltd of Huddersfield, deals with the Holmes Catco process by which combustible fumes, etc, are converted to odour-free gases. Copies are obtainable from the Company.

Exhibitions and Conferences

Mining Machinery Exhibition

The next exhibition of the Council of Underground Machinery Manufacturers will be held in the Grand Hall, Olympia, London, from 9-18 July 1959.

British Plastics Exhibition Renamed

The next British Plastics Exhibition and Convention, to be held at Olympia, London, 17-27 June 1959, is to be renamed the International Plastics Exhibition and Convention.

The fifth event of its kind, and the second to show international exhibits, it will again be organized by *British Plastics* with the full support of the British Plastics Federation.

Conference on Corrosion

Papers on corrosion problems associated with water flood operations, tubing and casing corrosion, condensate wells, and dissolved gases will be given at the 14th Annual Conference of the National Association of Corrosion Engineers. The 17-21 March 1958 sessions will include 17 symposia, two round table discussions, and meetings of more than 70 technical committees, many of them occupied with petroleum production problems.

Among the symposia scheduled are those on protective coatings, oil and gas production, the refining industry, cathodic protection, inhibitors, pipelines, plastics, underground corrosion, marine environments, the chemical industry, high purity water, and utilities. An exhibition will be held from 18-20 March.

All technical sessions and some committee meetings, as well as the exhibition, will be held at San Francisco's Civic Auditorium. The conference is open to all persons interested in corrosion control whether or not members of the National Association of Corrosion Engineers.

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Gas Chromatography

The second symposium on "Gas Chromatography" will take place at the Tropical Institute, Amsterdam, from 19–23 May 1958. It is being organized by the Gas Chromatography Discussion Group of the Hydrocarbon Research Group of the Institute of Petroleum and the Koninklijke Nederlandse Chemische Vereniging, and the programme will be divided into three sections:—

A. Theoretical
B. Apparatus and techniques
C. Applications.

The official language at the symposium will be English. Contributions, which should be original in character, are invited and a 250-word abstract in duplicate should be forwarded to the secretary, G. Dijkstra, Unilever Research Laboratory, Veersingel, Vlaardingen, Netherlands, before 20 Nov 1957. Those papers describing applications of the techniques should have some novel feature. Authors of papers selected for inclusion will be notified by 10 Dec 1957 and final manuscripts (6 copies) must be received by 20 Jan 1958. Application for registration must reach the secretary before 1 March 1958, the fee being approximately 45 guilders, which will include the cost of preprints and receptions.

★ ★ ★

SITUATION VACANT

PETROLEUM ENGINEER

RIO TINTO MANAGEMENT SERVICES (U.K.) LIMITED seeks for service in Trinidad a Graduate Petroleum Engineer of at least five years field operational experience covering the following: General drilling (including directional) and production work, mud control, production fracturing, heavy viscous oil production, well productivity studies and secondary recovery methods. Provident Fund, free medical attention, low rental accommodation provided. Salary up to £2,250 per annum. Candidates can be interviewed in London, California, or Trinidad. Write in first instance to Rio Tinto Management Services (U.K.) Limited, Barrington House, Love Lane, London, E.C.2.

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Forthcoming Meetings

THE INSTITUTE

(*At* 61 *New Cavendish Street, London, W.*1., 5.30 *p.m.—tea* 5 *p.m.*)

Recent Engine Developments in Relation to Fuels and Lubricants. D. Downs, B.Sc.(Eng.), A.M.I.Mech.E., A.F.Inst.Pet. **4 December**

IP ESSEX BRANCH

(*Place of Meeting to be Arranged*)

The Petroleum Chemical Industry in Gt Britain and the United States. L. Holliday, M.A., B.Sc., M.I.Chem.E., A.F.Inst.Pet. **22 November**

(*At the Railway Hotel, Pitsea*, 7.30 *p.m.*)

Recent Developments in the Gas Industry. L. J. Clark, B.E.M., M.Sc., A.F.Inst.Pet. **6 December**

IP FAWLEY BRANCH

(*At Esso* (*Fawley*) *Recreation Club, Holbury*, 7.30 *p.m.*)

Oil Searching in the U.K. B.P. Exploration Co. Ltd. **29 November**

Annual Dinner. **20 December**

IP LONDON BRANCH

(*At* 26 *Portland Place, London, W.*1, 6 *p.m.—tea* 5.30 *p.m.*)

The British Motor Industry. E. Woodbridge. **21 November**

(*At Shell-Mex House, London, W.C.*2.)

Film Evenings. **6 and 13 December**

IP NORTHERN BRANCH

(*At the Engineers' Club, Albert Square, Manchester* 2, 6.30 *p.m.*)

Technical Service and Quality Control in a Marketing Company. W. S. Ault, B.A., F.Inst.Pet. **19 November**

(*At Warners' Theatre and Old Nag's Head Hotel, Manchester*, 5.30 *p.m.*)

Film Show and Hot Pot Supper. **10 December**

IP SCOTTISH BRANCH

(*At North British Station Hotel, Edinburgh*, 7 *p.m.*)

Joint Meeting with Scottish Section of the Institute of Fuel

(1) Measurement of Size of Droplets from Convergent and Divergent Nozzles used in Oil Burners for Steel Furnaces. E. J. Burton and J. R. Joyce.

(2) Flow and Disintegration of Sheet of Visco-elastic Fuels. N. Dombrowski, P. Eifenklams, and R. P. Fraser. **21 November**

(*At Recreation Hall, BP* (*Grangemouth*) *Refinery*, 7.30 *p.m.*)

Automation in the Oil Industry. Member of BP Staff. **19 December**

IP SOUTH-EASTERN BRANCH

(*At King's Head Hotel, Rochester*, 7.45 *p.m.*)

Corrosion and Corrosion Prevention. P. A. Raine.

Film: *Supersonic Flight*. **3 December**

IP SOUTH WALES BRANCH

Meeting to be Arranged. **12 December**

IP STANLOW BRANCH

(*At Blossoms Hotel, Chester*, 7.30 *p.m.*)

Wrought Steels for the Petroleum Industry. S. Barraclough, A.Met., F.I.M. **20 November**

Joint Meeting with the Royal Institute of Chemistry

The Manufacture of Paint and Lacquer Solvents from Petroleum. F. E. Hixon, B.Sc. **18 December**

IP ECONOMICS AND OPERATIONS GROUP

(*At Mezzanine Cinema, Shell-Mex House, Strand, London, W.C.*2, *at* 5.30 *p.m.*)

Relations Between the Oil Industry and the Automobile Industry. W. S. Ault. **14 November**

OTHER SOCIETIES

THE INSTITUTION OF CHEMICAL ENGINEERS

(*At The Geological Society, Burlington House, London, W.*1, 5.30 *p.m.*)

Shell Gasification Process and its Application to Industry. M. J. Gattiker. **3 December**

North Western Branch

(*At Birkenhead Technical College*, 7 *p.m.*)

The Selection and Operation of Solvent Extraction Equipment. J. A. H. Walker (Student). **3 December**

Industrial Reconnaissance

No Planned military operation takes place without careful probing of the tactical position. Similarly no soundly conceived plan of industrial development can proceed before adequate surveys have been undertaken. So logical is this that its statement seems superfluous. Yet every year hard earned capital is wasted by drills that grind expensively into disappointing substrata. A geophysical survey, expertly conducted, greatly reduces these preliminary risks and directs the way to a speedy conclusion of the development phase.

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The "WEIR VALVE" CAST STEEL WEDGE GATE VALVE to B.S. 1414

✻ *Manufacture*

Made by an Associated Company of THE WEIR GROUP and conforming to the high standard of workmanship and efficiency attributed to this well known organisation.

✻ *Design*

Fully in accordance with the requirements of British Standard 1414, and the leading Oil Companies' individual specifications.

✻ *Materials*

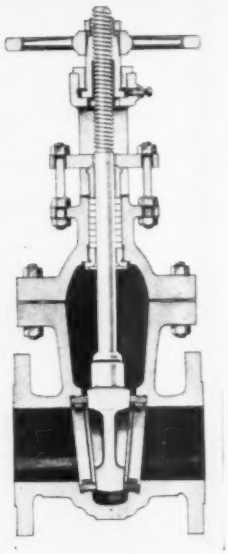
Accurate control of all constituent materials used in construction ensures that the valves are consistently up to specification.

✻ *Range*

Sizes 2" to 12" in Class 150 lb. and Class 300 lb. The standard trim material is the 11-13% Chrome Stainless Steel, but alternative materials can be offered when necessary.

DIMENSIONS IN INCHES

	Bore	Flange Diameter	Flange Thickness	F to F	Raised Face Dia.	Raised Face	Height
CLASS 150	2	6	⅝	7	3¼	1/16	18⅛
	3	7½	¾	8	5	1/16	22⅛
	4	9	15/16	9	6 3/16	1/16	27
	6	11	1	10½	8½	1/16	35⅛
	8	13½	1⅛	11½	10⅛	1/16	45
	10	16	1 3/16	13	12⅛	1/16	53⅛
	12	19	1¼	14	15	1/16	60⅛
CLASS 300	2	6½	¾	8½	3⅛	1/16	20⅛
	3	8¼	1⅛	11½	5	1/16	24⅛
	4	10	1⅛	12	6 3/16	1/16	30⅛
	6	12½	1 5/16	15⅛	8½	1/16	39⅛
	8	15	1⅜	16½	10⅛	1/16	47⅛
	10	17½	1⅝	18	12⅛	1/16	56⅛
	12	20½	2	19⅛	15	1/16	63⅛



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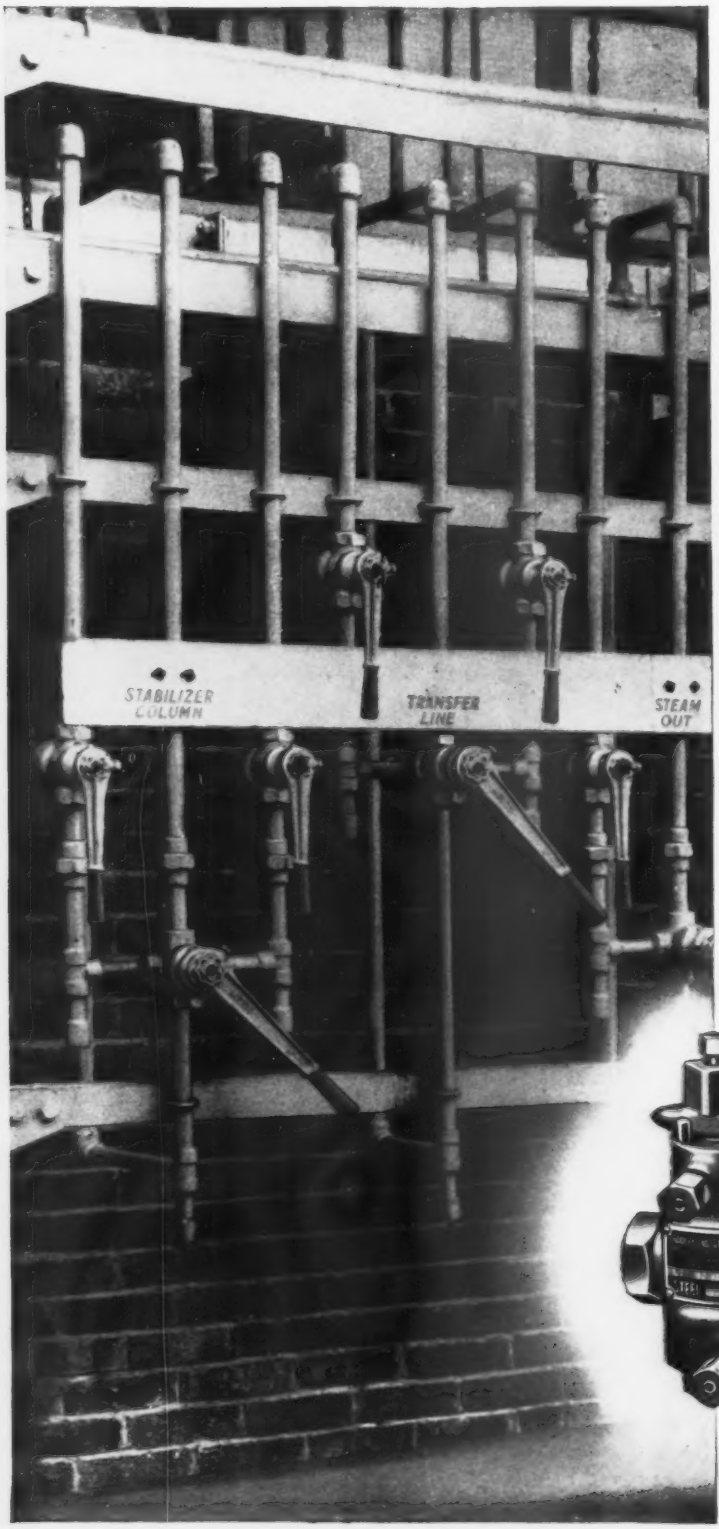

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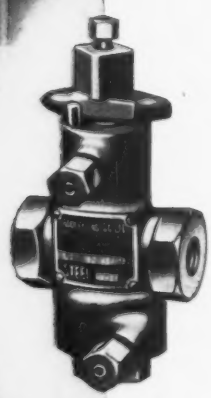

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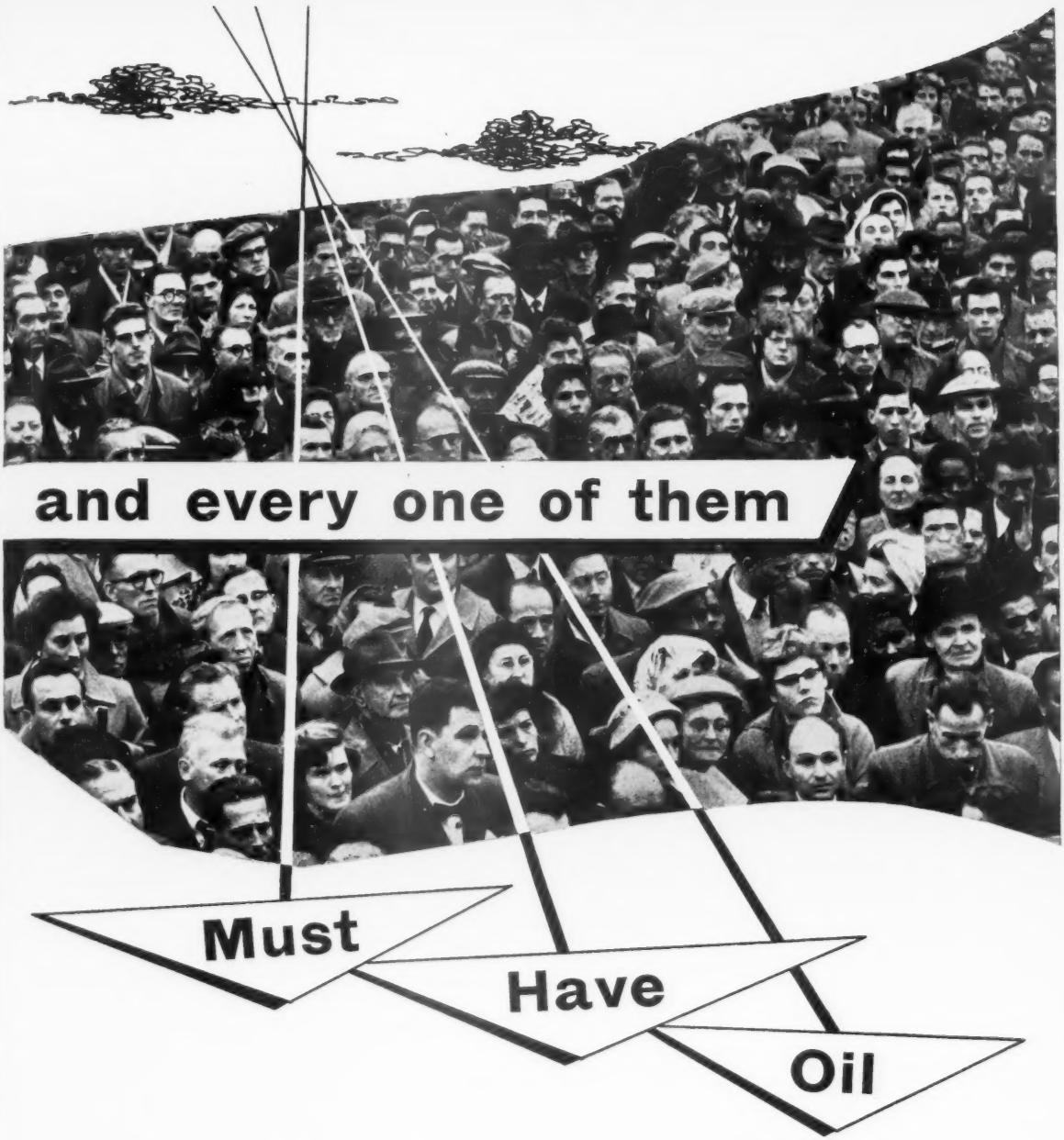

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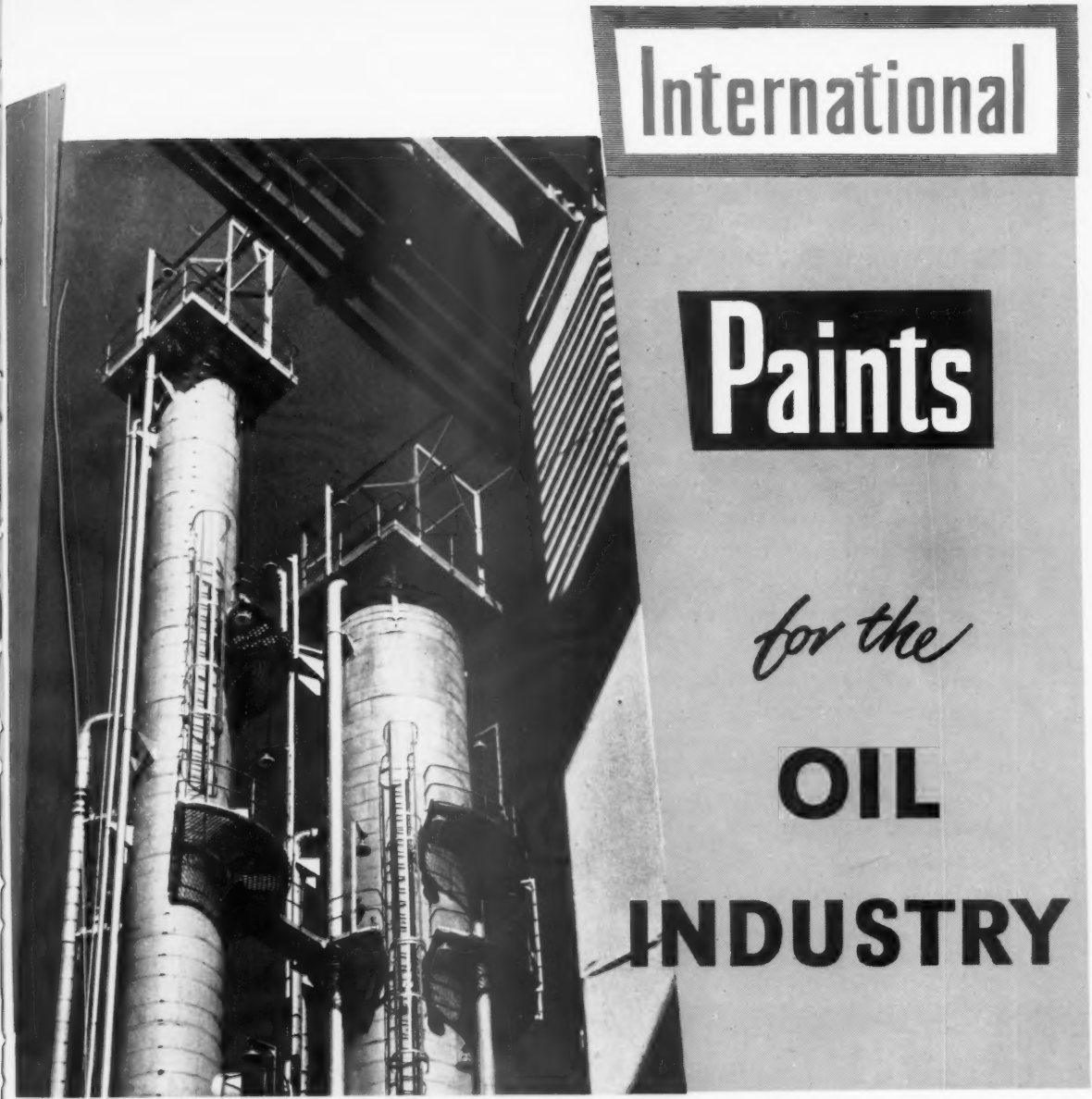

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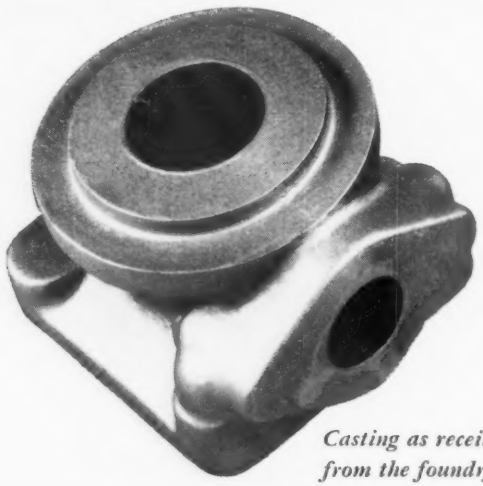
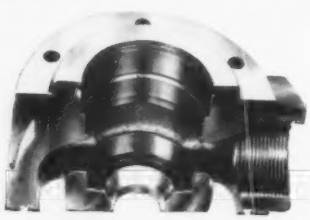


Casting as received from the foundry.

Finished machined casting.

HARPER CASTINGS

Sectioned casting showing the clean cored passages.



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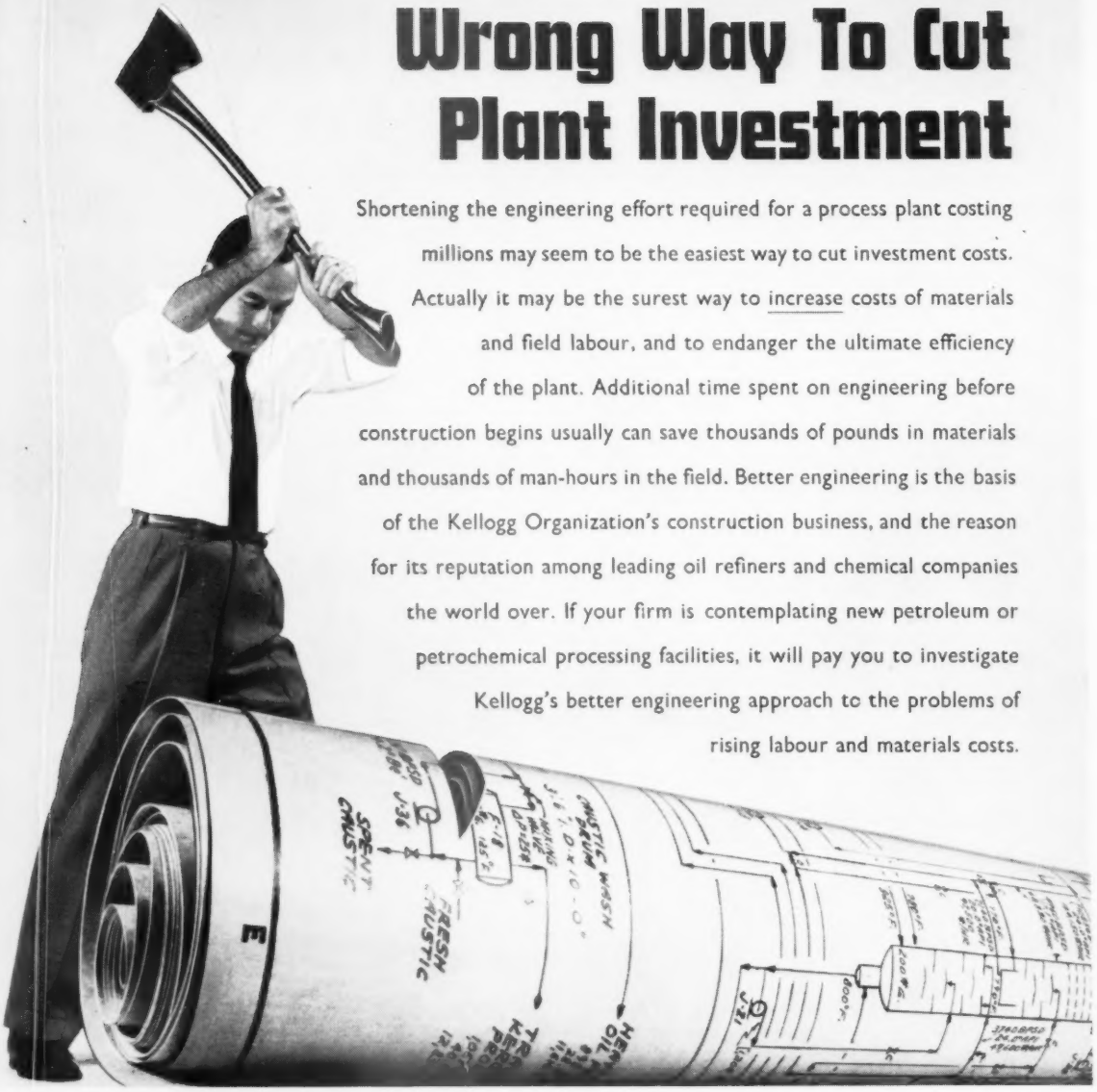
Wrong Way To Cut Plant Investment



Shortening the engineering effort required for a process plant costing millions may seem to be the easiest way to cut investment costs. Actually it may be the surest way to increase costs of materials and field labour, and to endanger the ultimate efficiency of the plant. Additional time spent on engineering before construction begins usually can save thousands of pounds in materials and thousands of man-hours in the field. Better engineering is the basis of the Kellogg Organization's construction business, and the reason for its reputation among leading oil refiners and chemical companies the world over. If your firm is contemplating new petroleum or petrochemical processing facilities, it will pay you to investigate Kellogg's better engineering approach to the problems of rising labour and materials costs.

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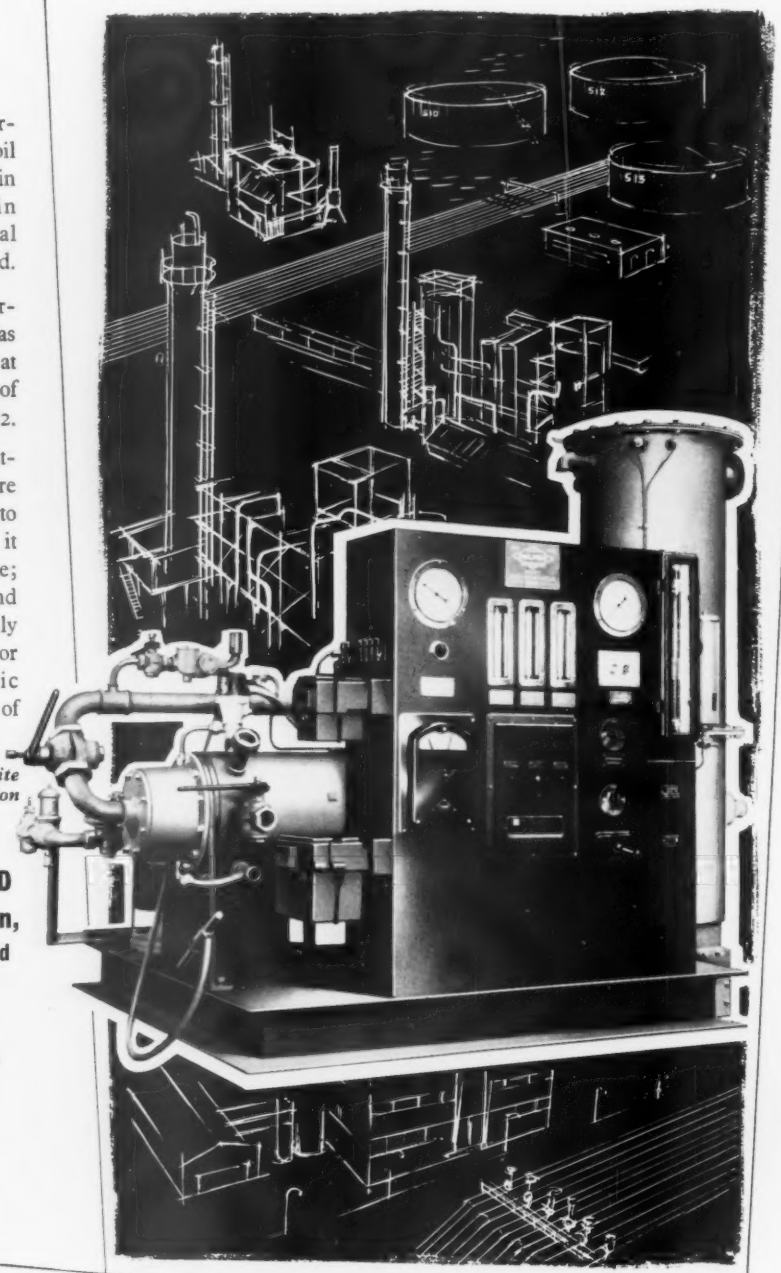
For full details please write for a copy of Publication No. 64/19



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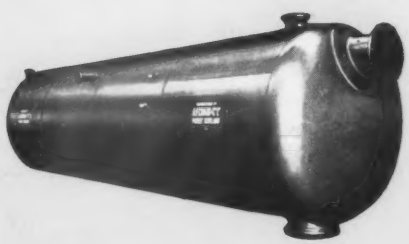
PRESSURE VESSELS

Illustration (left), shows a mild steel Disengaging Drum 12 ft. internal dia. by 40 ft. long overall, leaving the makers' works in Paisley for Esso Petroleum Co.'s Refinery at Fawley.

The dead weight of the drum is 23 tons.

It was designed and constructed in accordance with the API-ASME Code for Unfired Pressure Vessels. The welded seams were completely radiographed.



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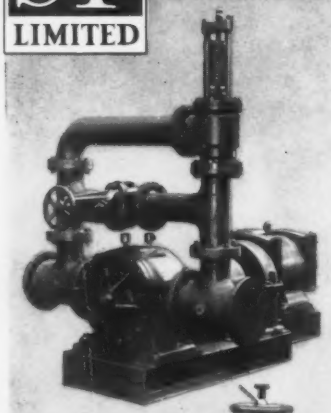
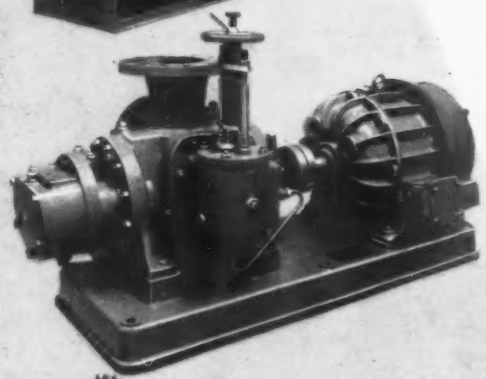
PUMPS



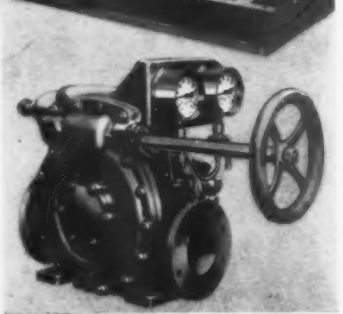
(Left)
Positive Acting Rotary Displacement Pump for the handling of Molasses and viscous fluids, electrically driven through totally enclosed Reduction Gear Box.

(Below)
Suitable for handling Spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.



(Above)
Positive Acting Variable Output Guinard Rotary Piston Pump. Electrically driven through Reduction Gear Box, for Oils of varying viscosity.

(Right)
Reversing Flow Rotary Displacement Pump for fitting on tank wagons. These pumps are driven from a power take-off on the gear box.



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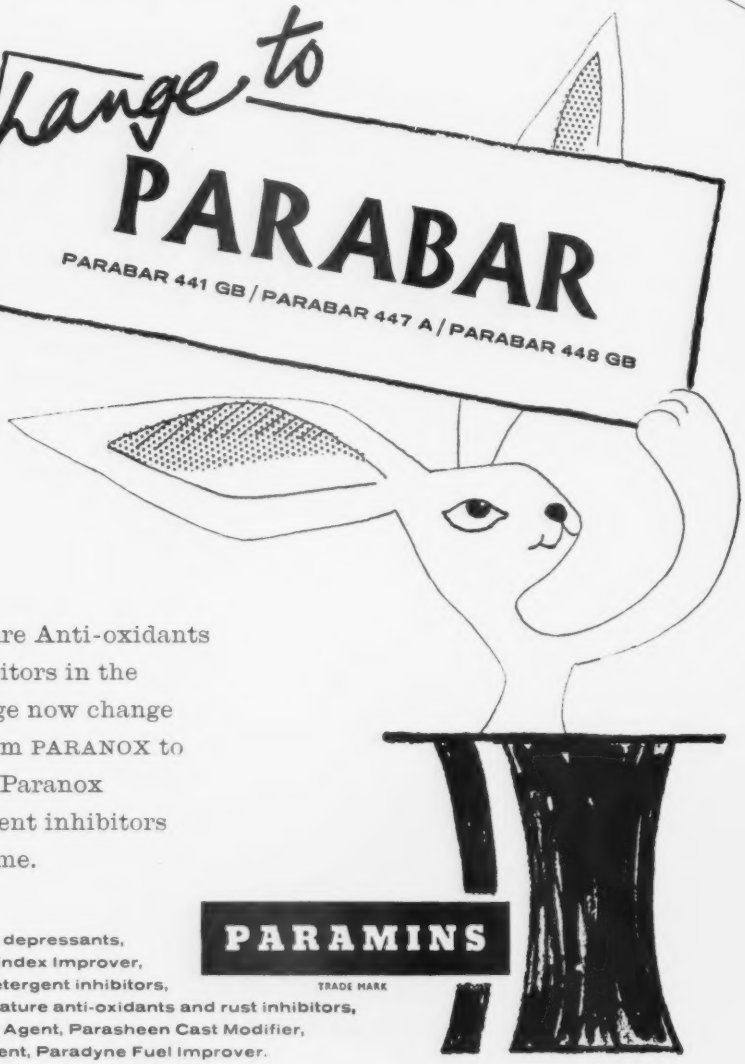

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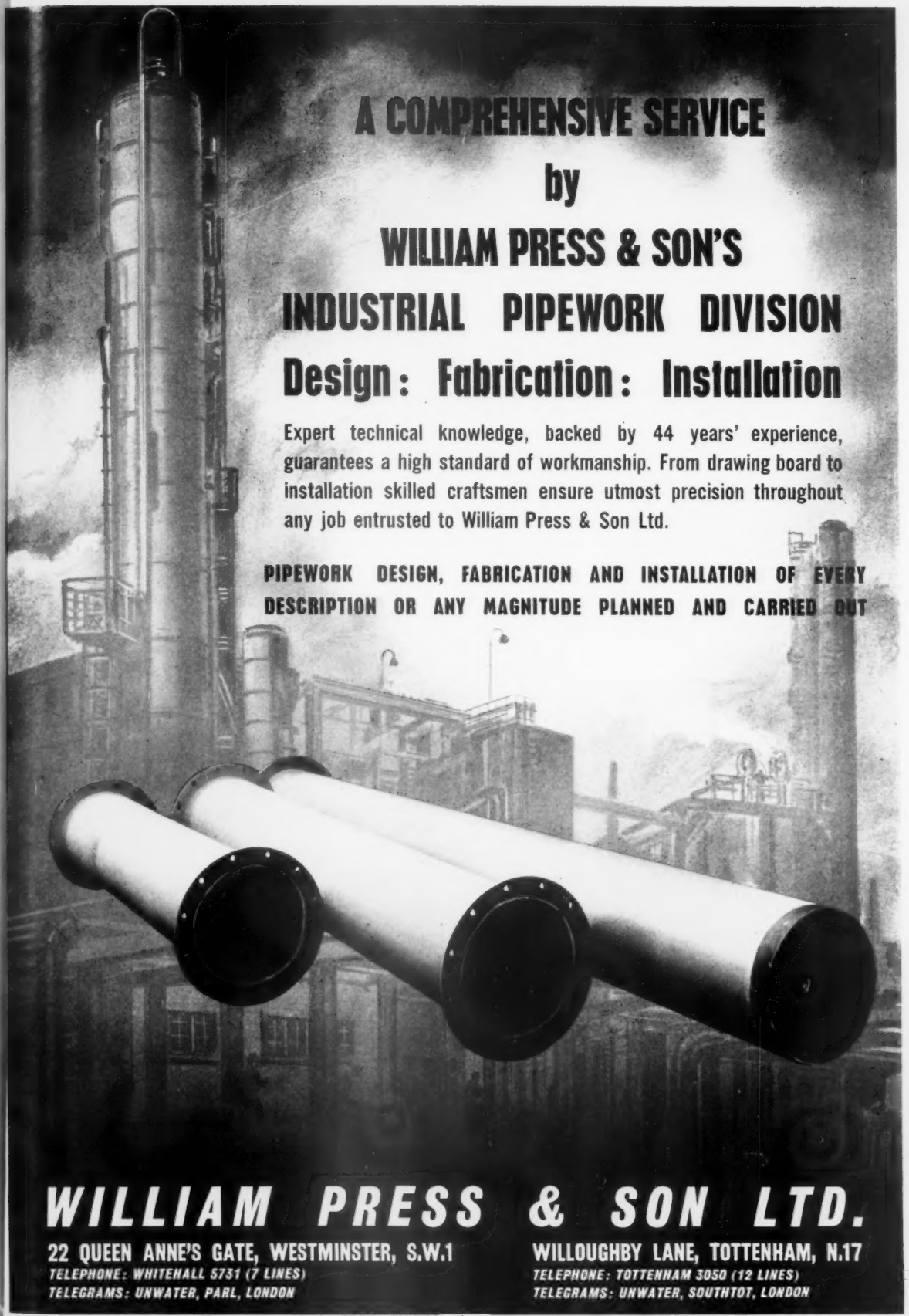

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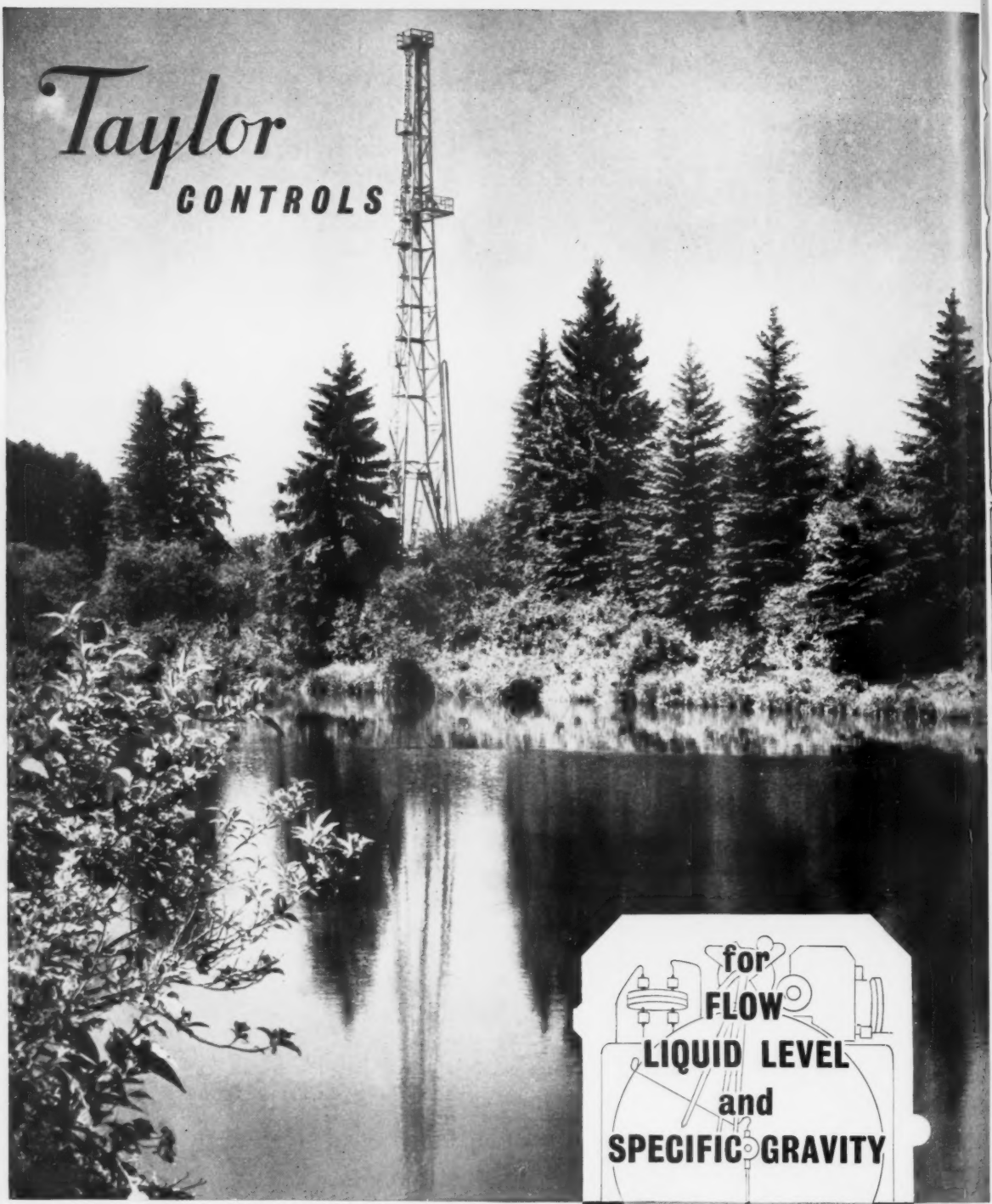
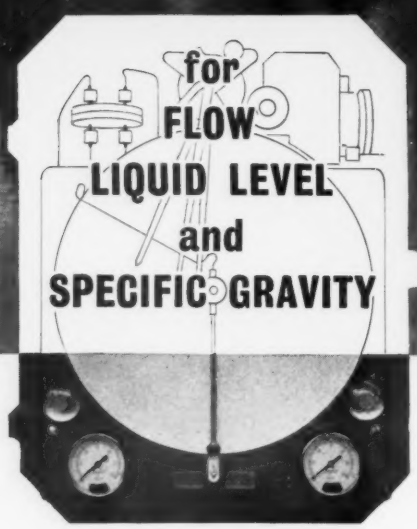


Alberta Government photograph

Flow Control Bulletin No.98175 will interest you. Details are also available on control of temperature, pressure, etc.



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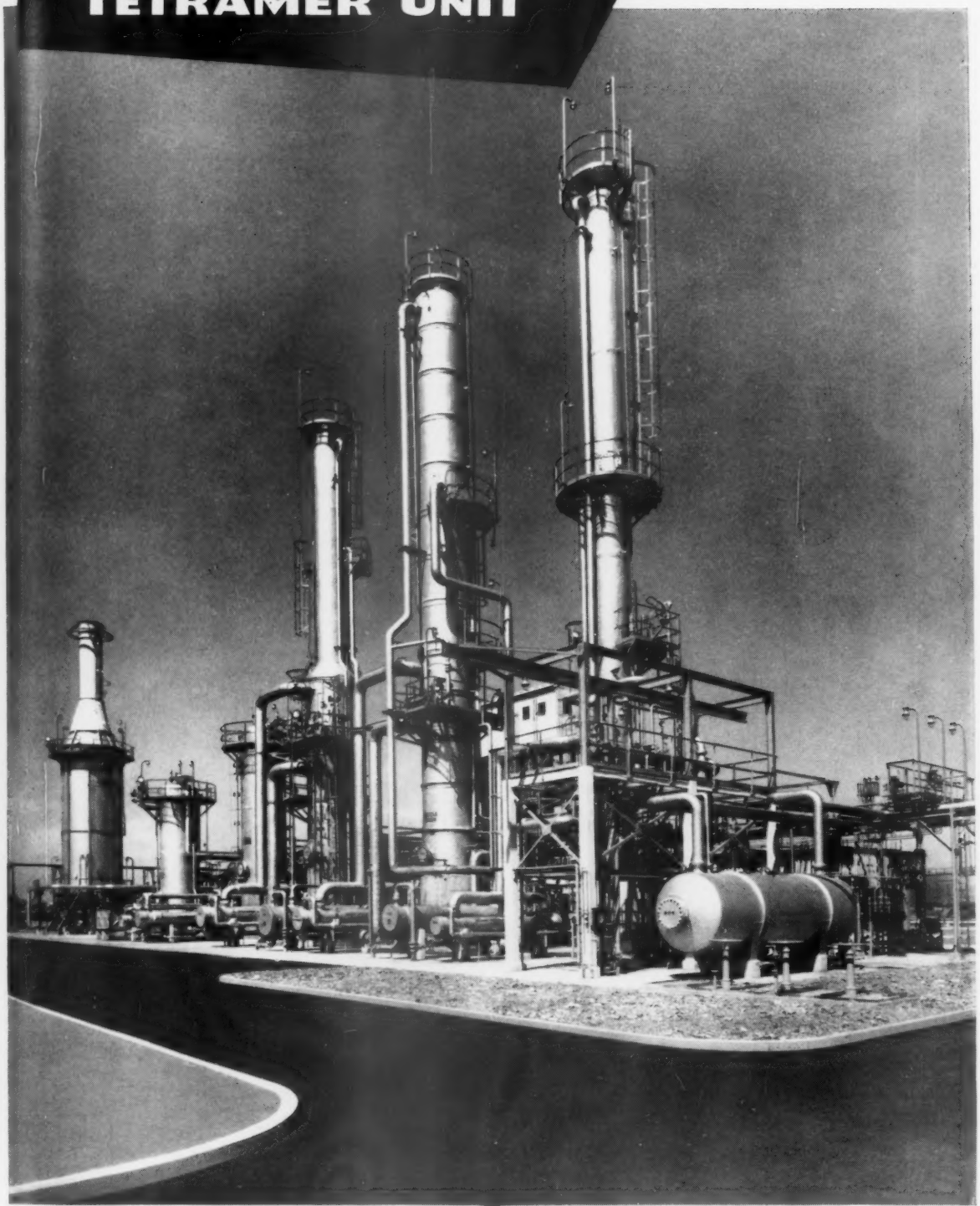

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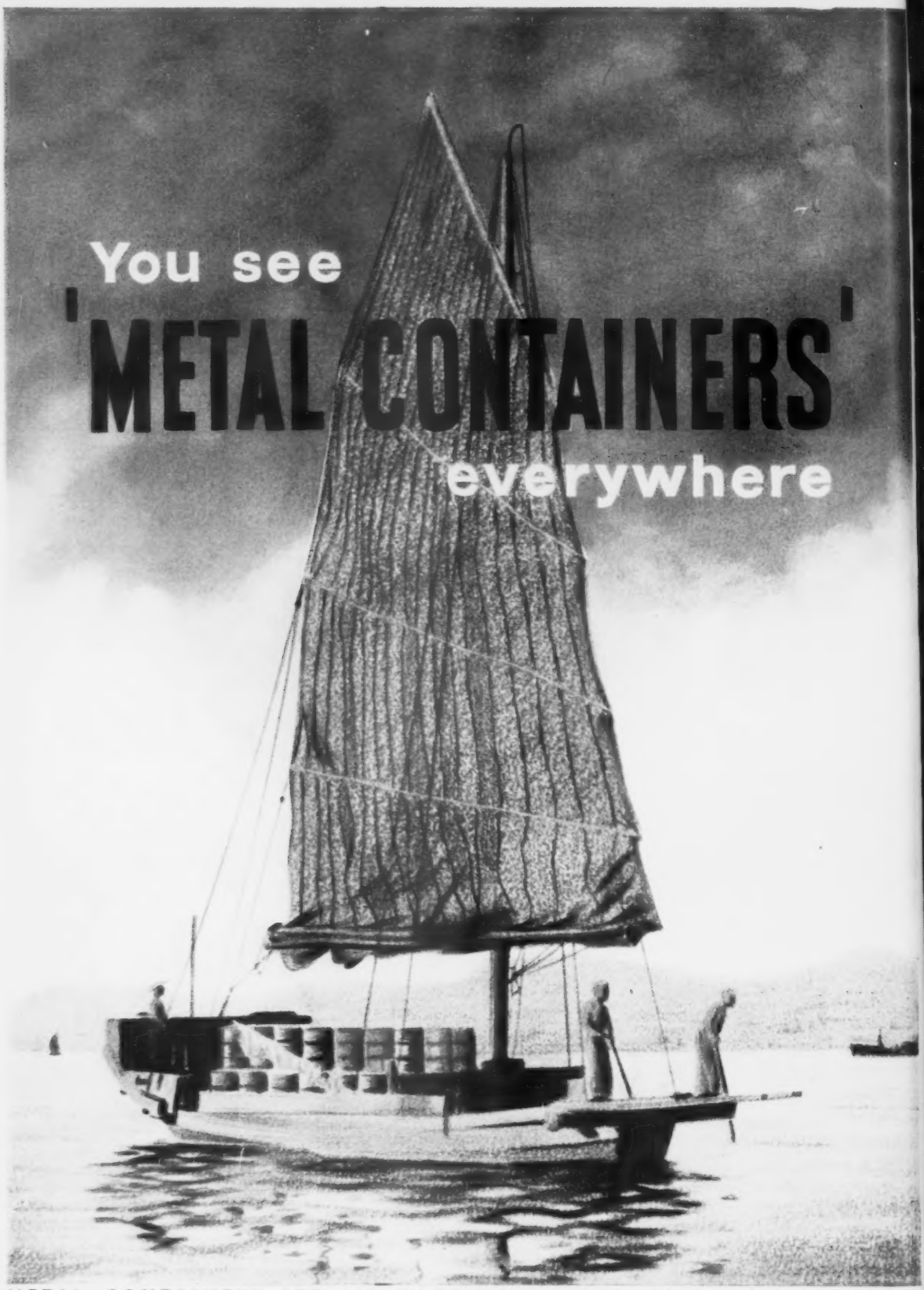

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